VOLUME 40
NUMBER 3

MARCH, 1953

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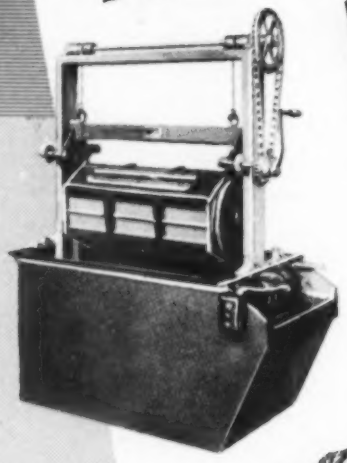

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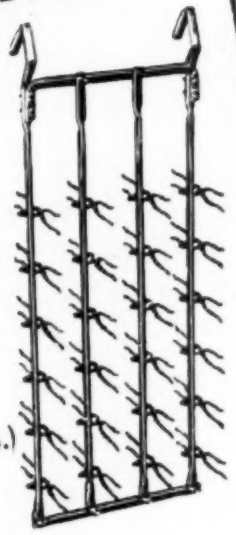

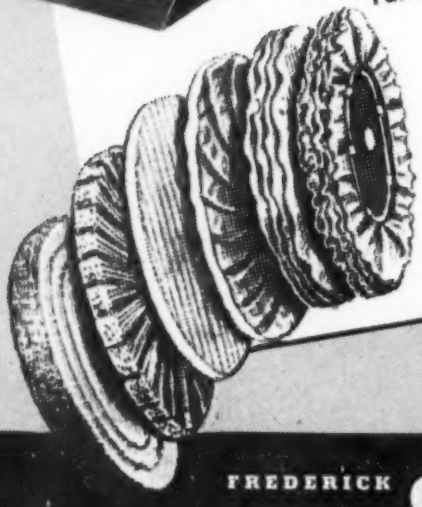

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In This Issue

Selenium Rectifiers for Electroplating by F. A. Waelterman and L. W. Reinken is a paper that describes the manufacture of selenium rectifier cells and stacks and concludes with a brief description of complete power supply units incorporating selenium stacks.

Practical Experiences with Bright Zinc Plating by A. Chesterfield is a practical paper that was originally presented at the 1952 A. E. S. Melbourne Branch Conference. Information is given on solution composition; use of brighteners which include coumarin (preferred), molybdic acid, thiourea, etc.; and bright dipping solutions.

Polarographic Determination of Lead in Lead Plating Solutions by Rafael Diaz is a second article submitted by the author in this field of analytical measurement. In this paper, illustrated with two figures and two tables, data are provided on the application of the polarographic method in lead plating solution analyses. An accuracy of 2 per cent is cited through use of the procedure.

40th Annual A. E. S. Convention. The Educational Program—Restaurant Information. Details advance information on about half of the technical papers and includes recommended eating places.

Disposal of Plating Room Wastes. V. Treatment of Cyanide Waste Solutions by Ion Exchange by Charles A. Walker and Walter Zabban is the concluding section of the paper, part one of which was published in the February issue. This section presents and discusses the results that were obtained in this Project No. 10 study and is illustrated with four tables and two figures. The report concludes that the dual ion exchange scheme was found more satisfactory than the single anion exchange treatment of very dilute copper, zinc and silver plating solutions (20–1000 ppm total CN) because the ions exchanged were recovered by regeneration in a more concentrated form.

For page numbers, see Table of Contents, page 251

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year, $1.00 per copy.

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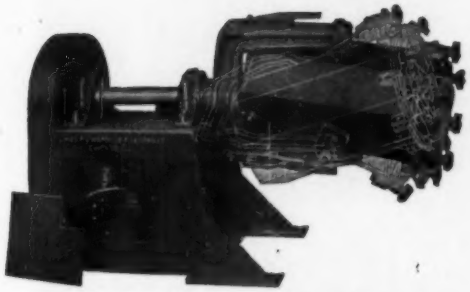

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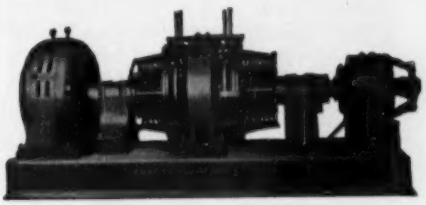

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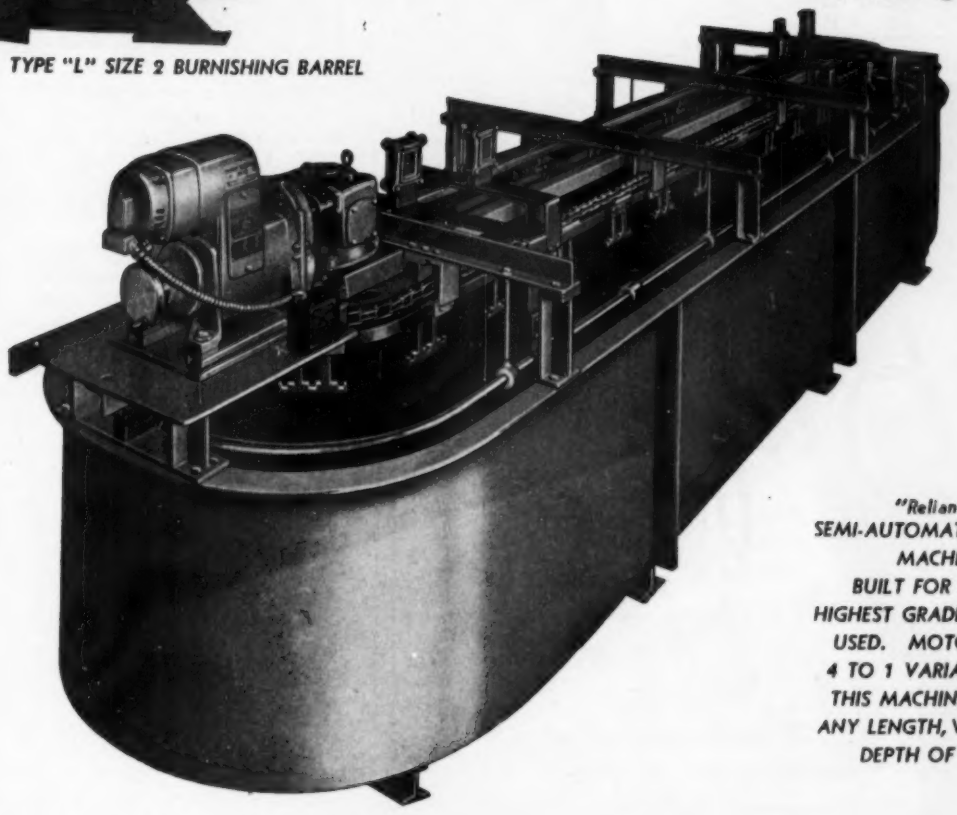

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Industry News

Beckman Expands National Sales Force. Beckman Instruments, Inc., has started a three month training program for 21 new sales engineers to carry the newest instrumentation techniques to manufacturers, research activities and processing industries throughout the United States. Hand picked on a basis of scholastic achievement and practical experience, these graduate engineers will complete the program which is a direct result of industry demand for help in developing instrumentation in automatic factory techniques.

Koroseal Lining Service. To augment service to the electroplating industry, Frederic B. Stevens, Inc., now has in operation at their New Haven branch, a complete department for the installation of Koroseal lining in plating tanks. The department, with facilities to handle tanks of any size or shape including the preliminary sand blasting where required, is under the supervision of well-trained personnel from the main plant in Detroit.

Columbia Machinery and Engineering Corporation has acquired all of the assets and manufacturing rights of the Bridgeport Safety Emery Wheel Company, Inc., of Bridgeport, Conn., and the Diamond Machine Company of Stratford, Conn. This action brings together three of the oldest machine tool producers in the country. The company expects to increase its volume approximately 50 per cent by the addition of the Bridgeport line.

Robert A. Emmett, former president of the Detrex Corporation, Detroit, manufacturer of industrial and dryecleaning equipment and chemicals, is shown (left) admiring a watch given him recently upon completing 30 years of service with the company. A. O. Thalacker (right), new Detrex president, gave the award to Emmett, who was elected chairman of the board

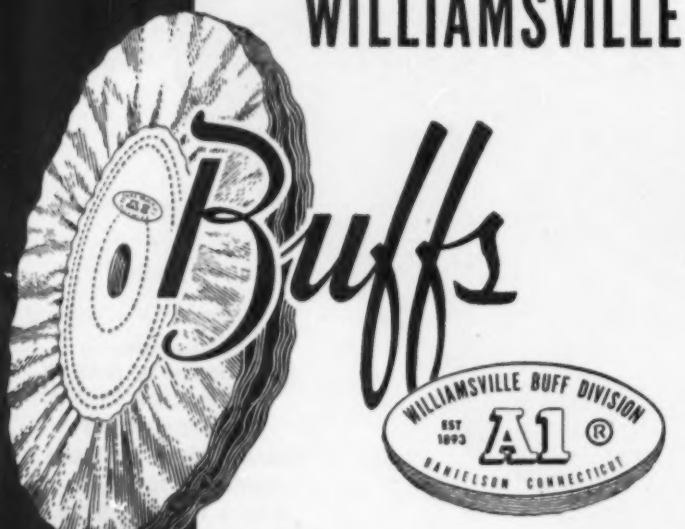
Metalweld, Inc., Philadelphia, Pa., announces the opening of their new Scotts Lane Plant which will house MW's Protective Coatings and Industrial Welding Divisions. Metalweld's Hunting Park Avenue Plant will remain headquarters for MW's Construction Equipment Division.

Corrosion Lectures. A series of ten lectures for the benefit of engineers in industries concerned with the problem of corrosion is being given at Stevens Institute of Technology, Hoboken, N. J.

The lectures are being sponsored by the National Association of Corrosion Engineers, and, under the general heading of "Prevention of Corrosion", will feature outstanding authorities in the field.

Robert S. MacCormack will be in charge of the series. Among the lecturers are T. P. May, E. A. Tice and F. L. La Que,, International Nickel Co.; C. L.

WILLIAMSVILLE



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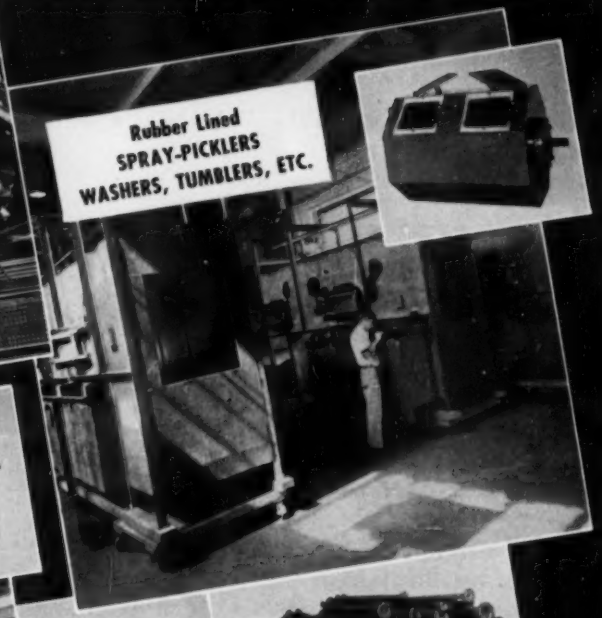

ARco engineers are unsurpassed in the custom tailoring of natural and synthetic rubber protective coverings for finishing equipment.

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Industry News

Bulow, Bridgeport Brass Co.; H. W. Fritts, Aluminum Company of America; L. P. Sudrabin, Electro Rust-Proofing Corp.; A. R. Black, Shell Oil Co.; A. G. Gray, Steel Magazine; G. W. Oxley, Standard Oil Development Co.; K. Tatot, Cornopolis, Pa.

Acid-Resistant Laboratory Coat Data. The Cross Island Laboratories of Franklin Square, Long Island, among the first users of Worklon laboratory coats

made of 100 per cent duPont Orlon, report that they are rolling up remarkable records for long wear under conditions usually fatal to most fabrics. Two of the Cross Island chemists point to almost two years of continuous wear of the same garments under rugged acid and chemical conditions. They also report that during this period the garments were never pressed . . . yet have always had a "just pressed" look. Before adopting these Orlon coats, the men had used up an average of eight cotton lab coats a year—destroyed and burned by acids and chemicals.

Start of construction on a new plant in Sharonville, Ohio, near Cincinnati has been announced by the Cincinnati Cleaning & Finishing Machinery Company, Ironton and Cincinnati, Ohio.

The new plant, scheduled for early completion, will comprise about 15,000 square feet of manufacturing space in addition to sales and engineering offices which will be moved from the present lo-

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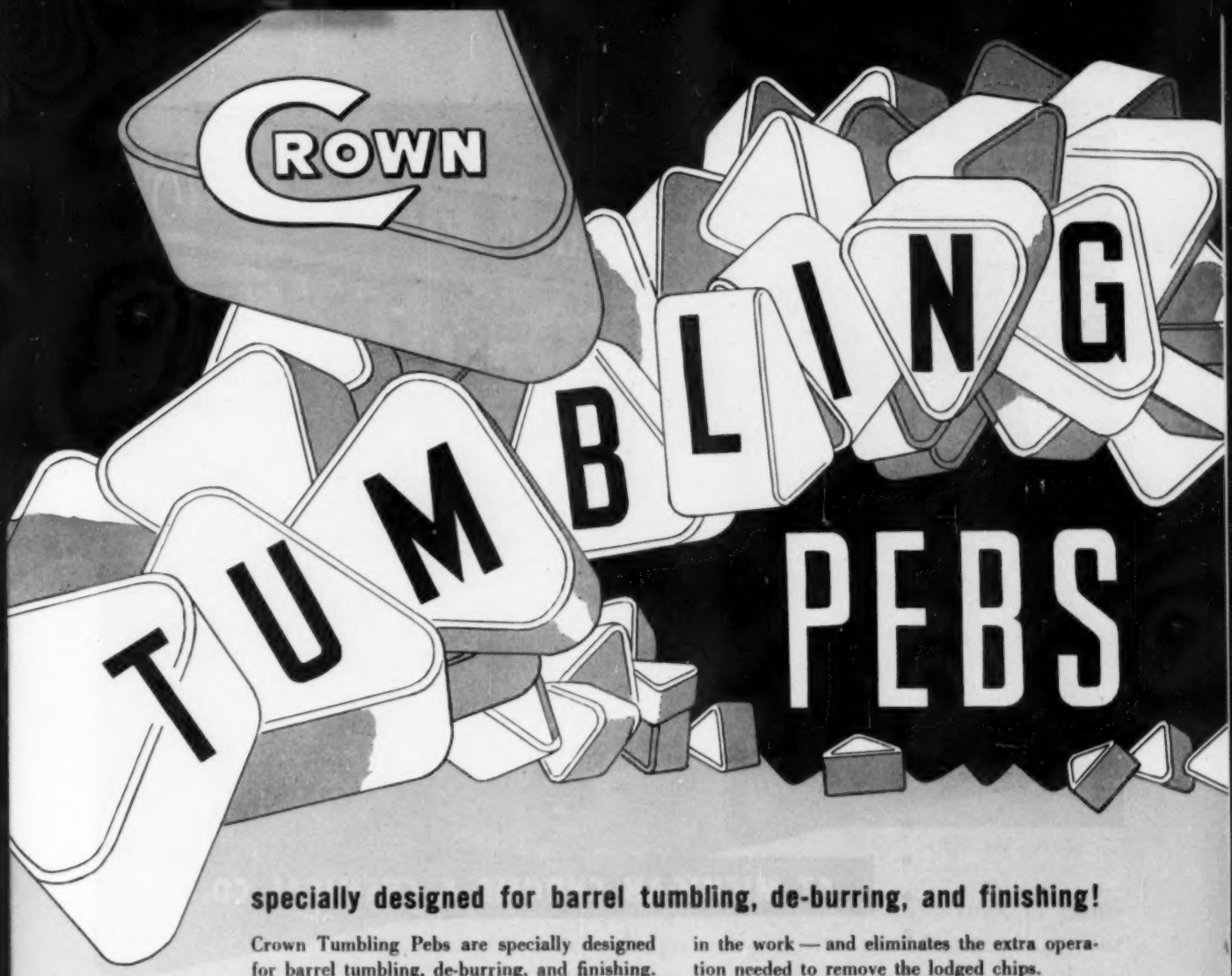

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Crown Tumbling Pebs are specially designed for barrel tumbling, de-burring, and finishing. They are manufactured of a tough, white ceramic, uniform in size and shape, and available in a variety of sizes. Crown Pebs have many advantages in tumbling operations and are widely used for de-burring and similar tumbling processes in many types of barrel tumbling equipment.

Eliminates lodging in holes . . . Crown Pebs eliminate the "lodgement" hazard of random shaped chips. Just select the proper size, and the uniform size and shape of the Crown Pebs eliminates lodging in holes, recesses, and slots in the work — and eliminates the extra operation needed to remove the lodged chips.

Longer life . . . The tough wear resistant ceramics in Crown Pebs give a service life several times longer than either natural stones or the aluminum oxide type of tumbling chips.

Crown Tumbling Pebs do not cut as rapidly as random shaped natural stones and aluminum oxide chips, but the uniform results and their much longer life make them very valuable in many tumbling and de-burring operations.

Samples sent on request.

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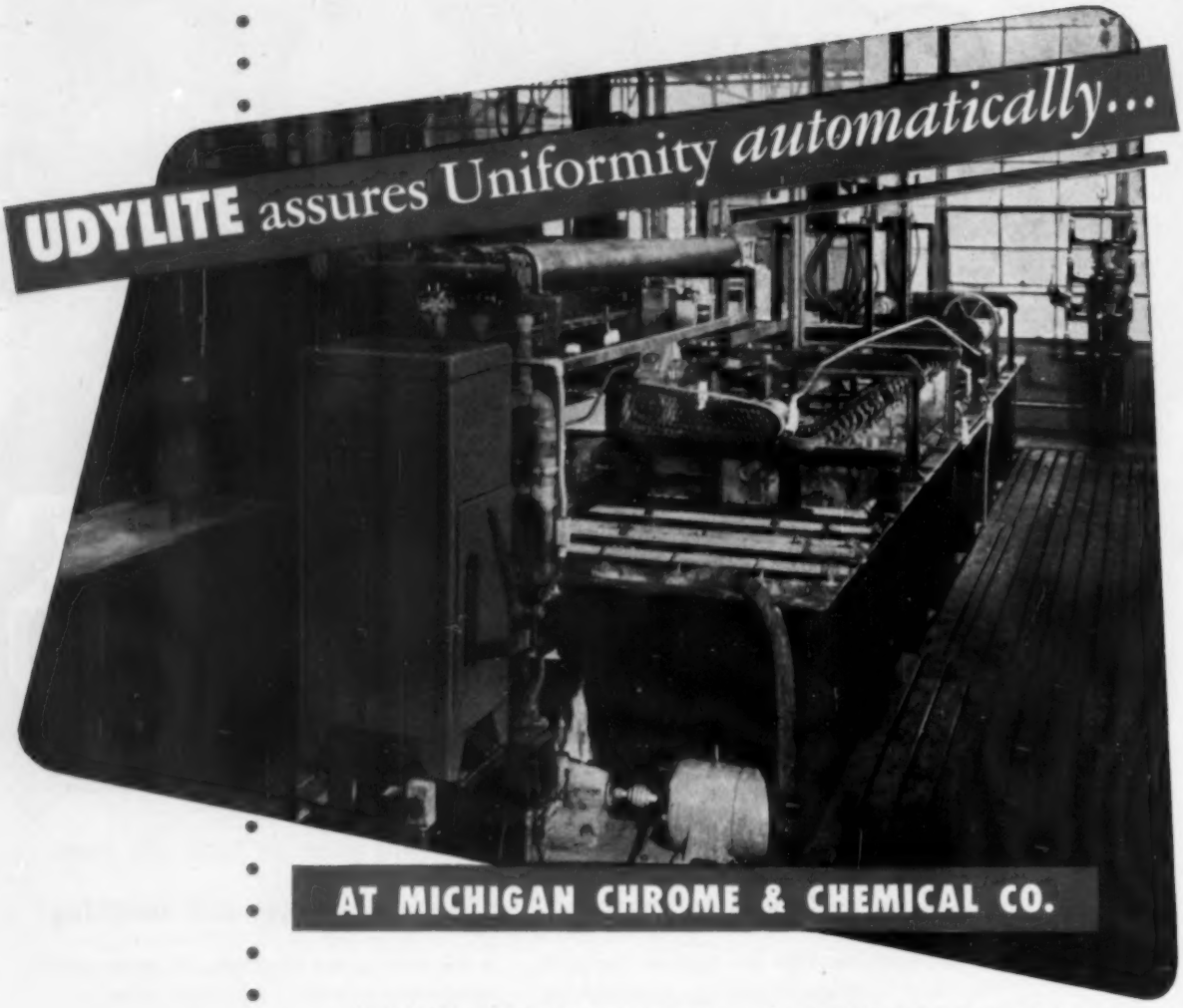

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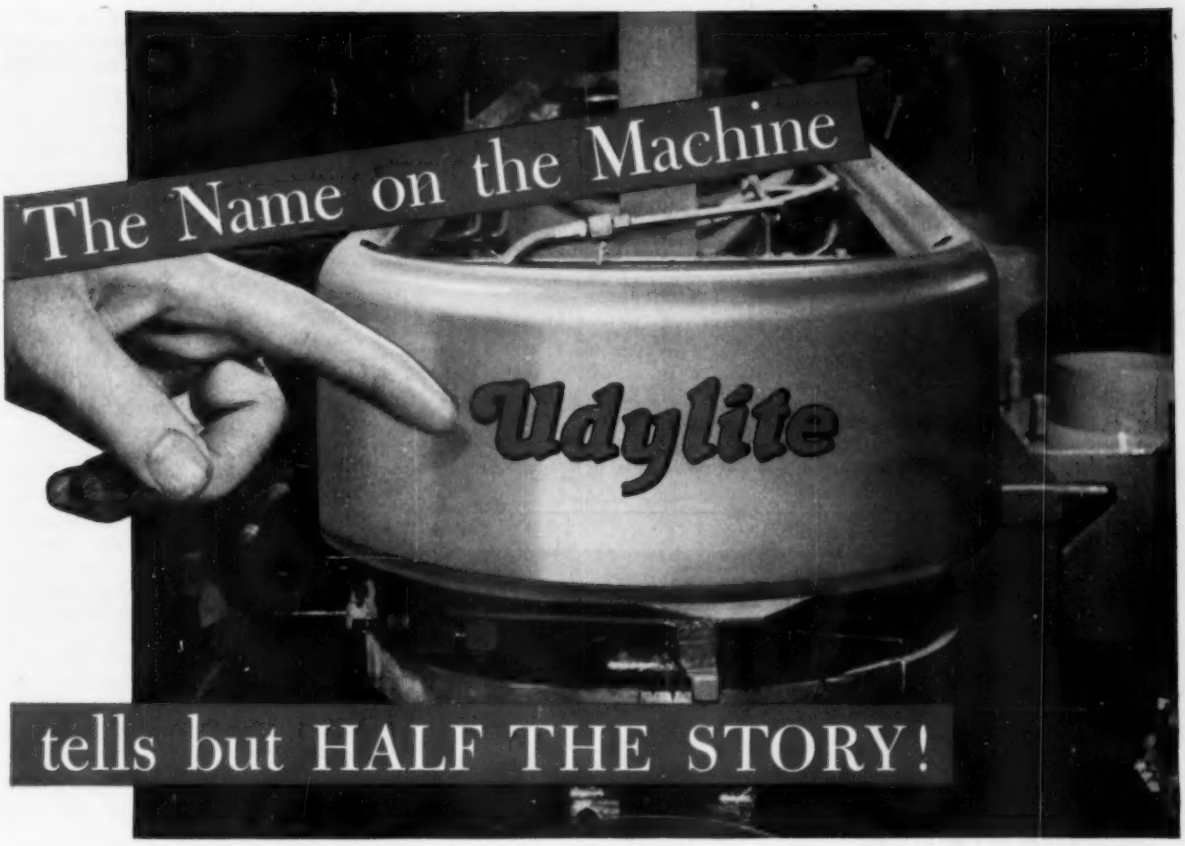

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THE Udylite CORPORATION
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cation in downtown Cincinnati. Operation of the Ironton plants will be continued.

Smoothex, Inc., announces the completion of their new modern plant at 10705 Briggs Road, Cleveland 11, Ohio. The new building contains up-to-date offices, laboratory and plant. This expansion further increases their capacity for the efficient handling of customer orders for the Smoothex bright nickel process.

Some years ago the Smoothex Corporation introduced their new bright nickel process after years of development research. The process can be used on most metals, has good line filling properties and can be operated at current densities from 5 to 100 amperes per square foot.

Titanium Facilities Expanded. Expansion of DuPont's titanium sponge producing facilities is now under way at its Newport, Del., plant and scheduled to begin shortly at its Edge Moor, Del., plant. This expansion will yield an estimated 13,500 additional tons of titanium sponge during the next five years.

New Facilities for F. B. Stevens of Canada. Frederic B. Stevens of Canada, Limited have announced the completion of new plant facilities in their Windsor, Ontario buffing composition plant. The facilities include new mass production forming equipment, designed for ease in materials handling, and special cooling apparatus to help achieve uniform quality, texture and cake size.

Permutit Plant Expansion. Coincident with the completion of Permutit's program for doubling the capacity of the Birmingham, N. J., works for the production of ion exchange resins, the company has now placed contracts for further extensions and improvements, including a new laboratory and pilot plant building. These new additions are provided to meet increased demands for ion exchange resins and are a part of the company's long-range plan to meet anticipated growth in the use of ion exchange processes in industry and power plants.

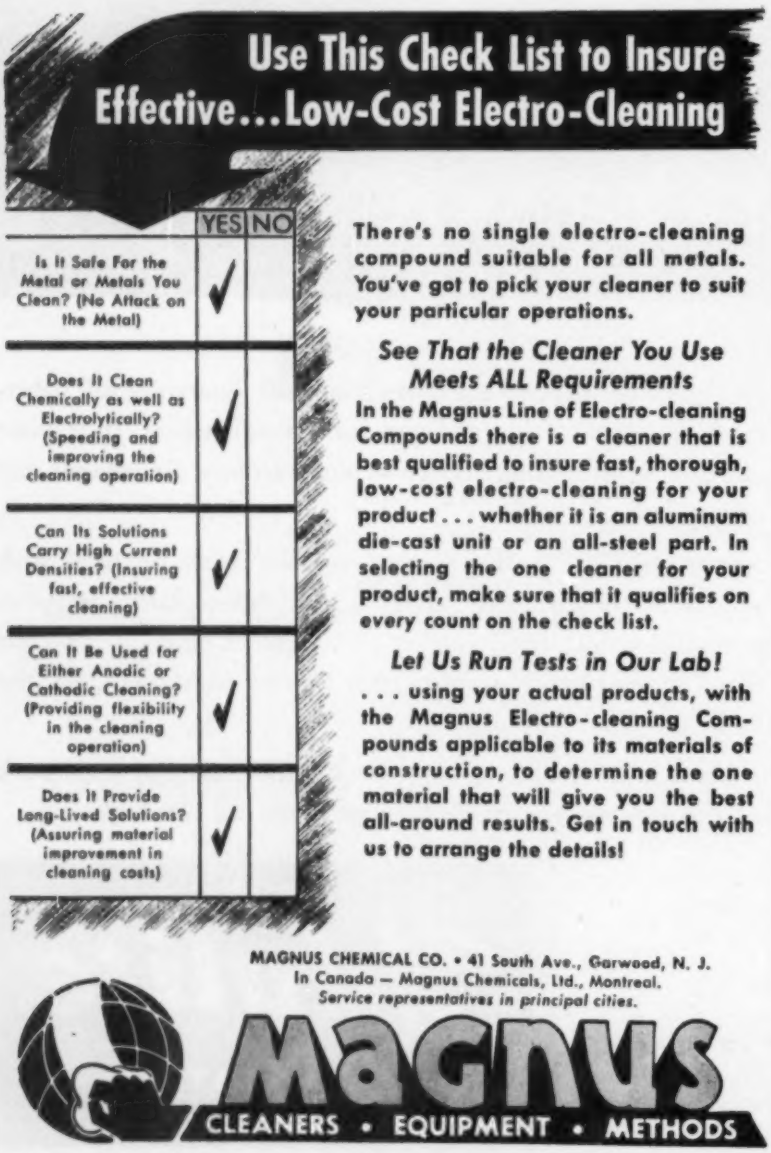
The Atlas Mineral Products Company, as part of its expansion program, announces the following appointments effective immediately: Kenneth Snyder, Western Division Regional Sales Manager; Edison C. Sickman, New York District Sales Manager; Frank Pegg, Sales Engineering at the Mertztown office; Donald Weidner, Sales Engineer in Northeastern Pennsylvania; John Pritchett, Sales Engineer in the Chicago territory; and John R. South, Sales Engineer in the Cincinnati territory.

Bersworth Fellowship in Chelate Chemistry. The Bersworth Chemical Company has announced a Bersworth Fellowship in Chelate Chemistry. The new fellowship provides for one year of graduate study and research at any accredited institution of the student's choice in the U. S. or under the jurisdiction thereof. It is open to all U. S. citizens who have completed at least one year of graduate study and are currently working toward their Doctorate in any major branch of science. The stipend is $3,500 payable in advance.

The Selection and Advisory Committee that will announce the first award in the spring of 1953 consists of a distinguished group of chemists.

The schedule for the first half of 1953 is being announced by the DeVilbiss Company for courses of instruction in industrial spray finishing methods in its School of Spray Painting, now in its twenty-seventh year of tuition-free operation for users of DeVilbiss equipment. Applications should be made as early as possible for enrolling foremen, shop superintendents, maintenance supervisors, spray operators and any others who wish to attend the week-long classes as follows: March 16, April 13, May 18 and June 22.

These classes will be held in the modern school headquarters now in operation adjoining the main plant at Toledo. Applications for all classes on the new schedule should be sent now to the De Vilbiss Company, Toledo 1, Ohio.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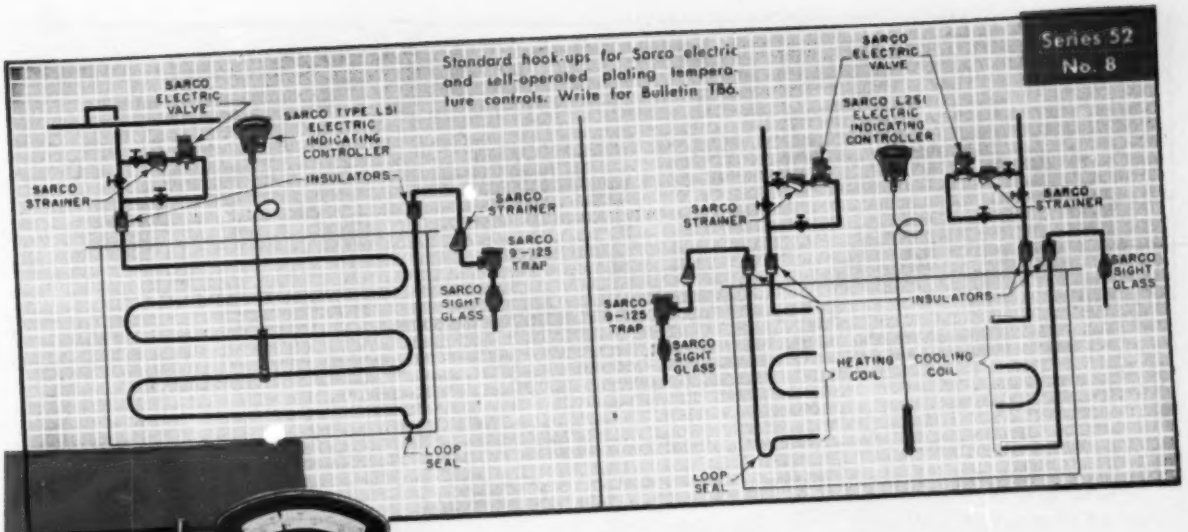
Standard hook-ups for Sarco electric and self-operated plating temperature controls. Write for Bulletin T86.



SIMPLIFIED
temperature control for electroplating

Sarco LSI Electric Temperature Controller.

Sarco L2SI Controller holding the temperature of the solution to plus-minus 1°F in this chromium plating tank. Photo through courtesy of Brunswick Radio Corp., Chicago.

Sarco LSI Electric Temperature Controller used in copper and chromium plating of rotogravure rolls at Southern Gravure Service, Louisville, Ky.

● PERFECT PLATING depends upon close control of several variables, of which temperature is one of the most critical.

In the case of chromium or nickel, it must be easy also for the operator to change to a higher or lower temperature setting for different jobs.

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A similar Controller, the L2SI is equipped with two independent switches to control both heating and cooling as is usually required in anodizing, hard chromium, bright nickel and other electroplating processes which generate heat.

Full information in Technical Bulletin No. 6

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Sarco Type TR-22, a simple self-operated temperature regulator recommended for copper, bronze, nickel, zinc, tin plating and acid pickling tanks in which critical temperature control is not necessary and settings are not changed frequently.

SARCO saves steam
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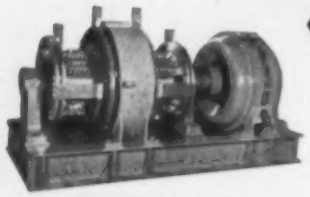

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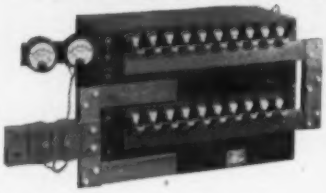

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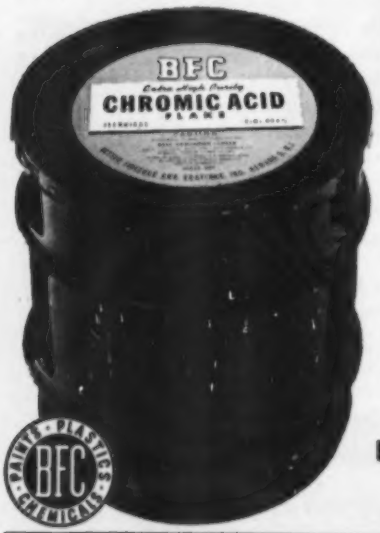

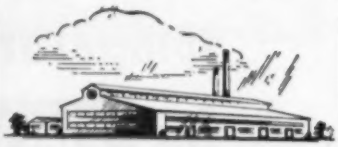

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Our plant is modern; beautifully equipped; operated by men who are proud of the product they make.

FRIENDLY, PERSONAL SERVICE

You can get a quick, unequivocal "Yes" or "No" on your Chromic Acid requirements from interested owner-principals who value your business.

We have yet to have a legitimate complaint on the quality of B.F.C. Chromic Acid. Its chemical analysis is as fine as its physical appearance!

One Price. One Standard of Quality and Service to all—whether the market is short or long. Distributor Stocks in many Principal Cities.

BETTER FINISHES & COATINGS, INC.
268 Doremus Avenue, Newark 5, N. J.
122 East 7th St., Los Angeles 14, Calif.

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Society News

M. F. S. A. Golf Tournament

The Metal Finishing Suppliers' Association will sponsor a golf tournament at the A. E. S. National Convention on Tuesday, June 16, at the Merion Golf Club, Ardmore. The Club has stipulated that high handicap golfers play the West Course and the low handicappers play the East Course. Mr. Duffy suggests that all golfers keep their clubs in good condition and be primed for this event.

Masters' Electro-Plating Association

The New Executive Committee of the Masters' Electro-Plating Association, Inc. of New York City recently held the first of their meetings for the 1953 term. The Executive Committee comprises the following: Irving Berkman of Berkman Brothers; Joseph F. Brust of Brust Brothers, Inc.; Alfred D'Agostino of Albert Plating Works, Inc.; John Forbath of Star Chromium Corporation; Jesse Goldman of Grand Chromium Plating Company; Frank Kaiser of Long Island Mechanical Plating Company, Inc., the retiring chairman; Samuel P. Levy of R. Plumacher & Sons, Inc.; Julian Nelkin of Henry Nelkin, Inc.; Sal Novelli of Service Plating Company; Philip Ranno of Imperial Plating Company; and Philip Sievering of Philip Sievering, Inc. Phil Ranno was unanimously elected chairman by the committee, and Irving Berkman as Treasurer.

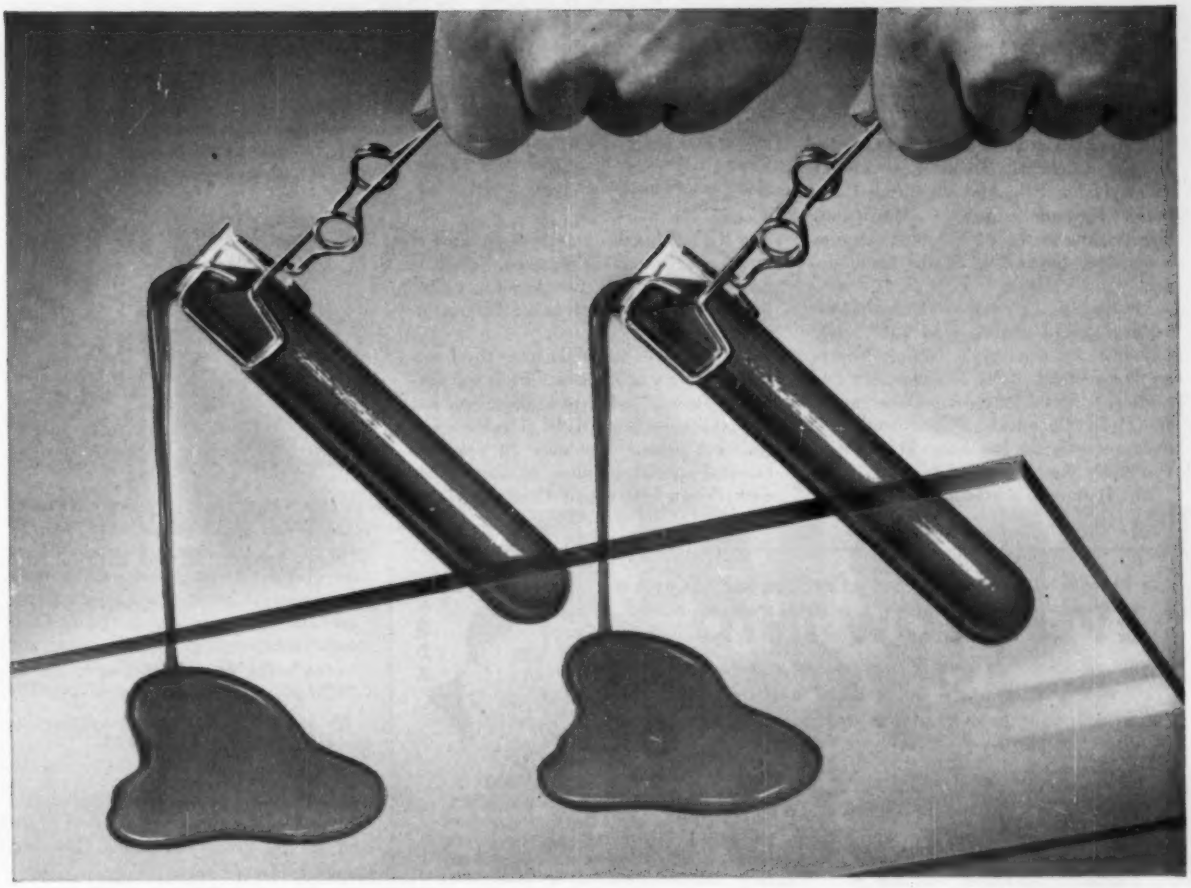
National Instrumentation Conference

The Electrical Engineering Department of Michigan State College, in cooperation with the National Science Foundation, the National Bureau of Standards, the Instrument Society of America, and the American Society for Engineering Education, announces an invitational National Collegiate-Industry-Government Conference on Instrumentation to be held on its campus, March 19–20, 1953.

The Conference is being called in recognition of the growing importance and potential of instrumentation in research and production, and to the national defense.

American Hot Dip Galvanizers Association

One of the highligl.ts of the 1953 Annual Meeting of the American Hot Dip Galvanizers Association in Cincinnati, Ohio on March 19 and 20 will be the presentation to the members of the "Manual of Cost Accounting Principles for the Hot Dip Galvanizing Industry". The manual, two years in preparation, has been written by galvanizers for galvanizers.



Which lubricant has increased tin plate production 15%?

Both lubricants look, feel and act alike — yet tin plate mills using the one on the right—Palmoshield—have increased production as much as 15%.

A leading steel company adopted Palmoshield for cold rolling operations and recently over a run of 20 consecutive shifts, production was stepped up 15% over the average output with imported oil. This increase was made with no additional investment, no increase in labor force, no extra machines and no changes in mill operation. Yet 115 tons of steel were rolled for every 100 before.

Nearly two-thirds of the major tin plate mills in this country and Canada are now using Palmoshield for regular mill operations or on-the-job-test runs.

Advantages of Palmoshield

Palmoshield is produced in the heart of the steel industry. Users are not dependent on overseas shipment from foreign controlled sources.

Palmoshield is made from domestic materials freely available in sufficient quantities to supply all American steel production.

Palmoshield need not be stockpiled by the user, yet it does not deteriorate in storage.

Palmoshield is tailor-made to your needs. Free fatty acid content can be controlled to within ½%.

Technical assistance for your own operations.

On request an Ironsides representative will give you facts on Palmoshield to help you set up a test program in your mill.

Palmoshield is available for same-day shipment in 55-gallon drums and tank car lots. For full information write The Ironsides Company, 270 West Mound Street, Columbus, Ohio.

SPECIAL LUBRICANTS and PRESERVATIVES

IRONSIDES SHIELD PRODUCTS **PALMOSHIELD**

Personals

Philip C. Staples has been appointed Chicago District Sales Manager of the Industrial Chemicals Department of the Pennsylvania Salt Manufacturing Company. He replaces **John C. Hampson,** who returns to the Philadelphia office as a Product Supervisor in the same department.

Mr. Staples, a graduate of Harvard University, joined Pennsalt in 1937. He served in the company's Technical Service Department, Sales Development Department, Metal Processing Department, Industrial Chemicals Department, and most recently he has been Manager of Pennsalt's Washington office.

Mr. Hampson, a graduate of the U. S. Naval Academy, joined Pennsalt in 1936 as a salesman in the Food Industries Department. He subsequently served in the Purchasing Department as an expediter and then returned to sales in Metal Processing and Industrial Chemicals. He was Chicago District Sales Manager for two years before his recent appointment.

Ike Farley has been named manager of a new office opened in Houston, Texas, by Annin Company of Los Angeles, manufacturer of control valves for various industrial applications.

Farley comes to Annin from the Lummis Company of Houston. He is a graduate of Drexel Technical College, and has had wide experience in the petroleum and chemical fields. For over 20 years he handled special accounts in these fields with Brown Instrument Company, Division of Minneapolis-Honeywell. Mr. Farley will be assisted by **E. H. Collender,** a graduate of Armour Institute of Chicago.

Edwin M. Close has been appointed Purchasing Agent by the Hanson-Van Winkle-Munning Company, Matawan, N. J.

Close

Close joined the Sales Department of Hanson-Van Winkle-Munning in 1941. In 1945 he was appointed Assistant Secretary of the Company and subsequently was made Assistant Purchasing Agent. Close has served as a member of the Cadmium Advisory Committee and the Electroplating Equipment Committee at NPA during the Korean Emergency.

He has a B.S. in Business Administration from Lehigh University.

John R. Gumm has been elected Executive Vice-President and General Manager of the Frederick Gumm Chemical Company, Inc., Kearny, N. J.

Gumm

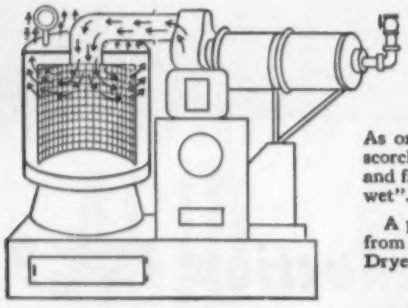
He attended Rutgers University, and then became affiliated with the Frederick Gumm Chemical Co., Inc., in July, 1936.

W. C. Kennedy has been appointed general sales manager of the Industrial Lubricants Company, Inc. At the same time, **Hubert E. Evans** was named chief chemist.

Kennedy comes to Industrial Lubricants with 20 years' executive experience in the automotive, materials handling, aircraft and industrial chemical and lubrication industries.

Evans, previously a technical director for a manufacturer in a related field, will be in charge of new product development and control. He has over 25 years' experience in research and development, engineering, and sales and customer service. He was recently elected chair-

EVER BLOW INTO AN ASH TRAY?

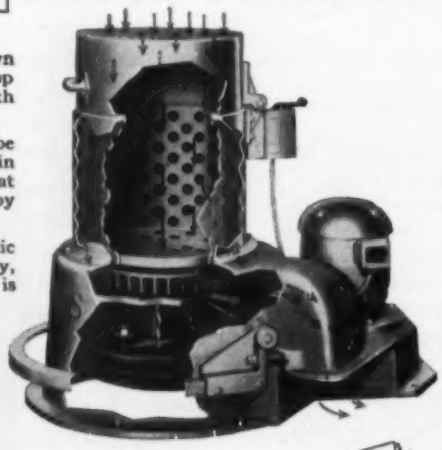


If you did, you saw a practical demonstration of the principle of air deflection. In old type dryers, air *blown* in from the top is deflected by the top layer of parts. As one user put it, "the top layer gets scorched, the next layer is nice and dry, and from there on down the parts are still wet".

A powerful suction fan *draws* the air from the bottom of the modern Nobles Dryer. Fresh air rushes in from the top to fill the vacuum and is drawn through the entire contents from top to bottom where it is expelled with the water.

Steam or electric heaters may be mounted compactly in the cover in contrast with space consuming, heat wasting, separate units connected by pipe.

An internal expanding, hydraulic brake stops the machine smoothly, and quickly. The "brake pedal" is a ring extending around the entire working area so that the machine can be stopped instantly from any working position. In the interest of faster drying and lower costs write today!



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..... without scratch brushing or buffing.

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BRIGHT GOLD PROCESS

Hundreds of firms tested SEL-REX Bright Gold Process and all enthusiastically adopted it as their new gold plating standard. There are many reasons . . . here are a few:

- Excellent gold "throwing power" and "hiding power."
- Produces fine grain, hard deposit.
- No gold lost because there is no scratch brushing or buffing required.
- Ideal for specification plating.
- Operates at room temperature.
- No complicated equipment required. Conventional racking may be used.
- Solution is stable and easily maintained.

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☐ Send 1-ounce of Sel-Rex Bright Gold Salts.

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NEW Sisal *Finger* Buff*

Sensational New-Type Construction

of CHURCHILL #20-RD **SISAL BUFFS**

Offers Four ***Exclusive*** *Advantages*

FINISHING ROOM FOREMEN REPORT

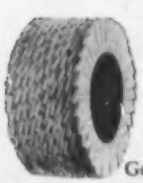
FLEXIBILITY never before achieved in a sisal buff!
In addition to the flexibility of each buff finger, the complete freedom of the sisal fibres within each finger gives the utmost in flexibility. With no spiral sewing, the Churchill #20-RD is ideal for work involving curved surfaces and recesses.

FASTER cutting action that's positively unbelievable!
This #20-RD is proving to be the fastest-cutting buff ever developed, because only the raw ends of each sisal fibre are in contact with the work, and they pick up and *retain* the cutting compound better.

LONGER wearing qualities hitherto unequalled!
Many foremen have found the wearing qualities of the #20-RD to be unmatched by any other buff they have ever used. It is manufactured with first-quality sisal twine only, which is specially processed and tightly twisted.

REMARKABLY smoother finish now possible!
Due to the exclusive use of imported combed sisal, the #20-RD produces a smoother finish that is not possible with ordinary sisal buffs.

Churchill #20-RD Sisal Buffs are competitively priced. Produced in all sizes from 6" to 18" diameters. Write for further information.



Geo. R. Churchill Co., INC.

CHURCHILL FINGER BUFFS*

*Trade Mark Reg. U.S. Pat. Off.

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FREE Catalog

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Please send me complete information about new #20-RD Sisal Buff. My special buffing problem is

.....

Name..... Title.....

Firm..... Specializing in.....

City..... Zone..... State.....

Personals

man of the Board of Science Service Systems, Inc., registered engineers and consultants.

G. J. Doss has been named general manager of the newly established Switchboard and Control Division of the Electric

Doss

Products Company, Cleveland, Ohio. He came to The Electric Products Company in 1946 as manager of the Cleveland District Office and in 1951 was advanced to assistant sales manager.

Arthur F. Gerada has been appointed as sales engineer on the Udylite Corporation's Cleveland district sales staff. Working out of the Cleveland office, he will call upon Udylite customers in the Cincinnati area.

Gerada

Gerada has been with Udylite for two years as a service engineer and control chemist in the Detroit customer service and pilot laboratories. Prior to joining Udylite, Gerada was graduated from Michigan State Normal College with a B.S. degree in Chemistry.

Solomon R. Baker of Worcester, Mass., and Beverly Hills, Calif., has been elected president of Pyrene Manufacturing Company of Newark, N. J.

Mr. Baker is senior partner of Baker and Baker, Certified Public Accountants, of Worcester, Mass., and is a member of the American Institute of Accountants.

George W. Mikkelsen has been appointed director of the Marine Chemical Department of Fine Organics, Inc.

Capt. Mikkelsen, a Navy Lieutenant of World War I with over thirty years' experience in the Marine field, is a member of the Port Engineers Society and Marine

Square Club, a life member of the Yacht Masters and Engineers Society and the Robert L. Hague Post of The American Legion.

James Gonyeau has been transferred by the Michigan Chrome & Chemical Company to the Chicago area as sales representative.

Gonyeau

Patterson

Richards

Mr. Gonyeau received his B.S. degree in Physics from Wayne University, Detroit, after completing several years' service in the Army during World War II. He represented Michigan Chrome & Chemical Company in Michigan for two years prior to assuming duties in the Chicago territory, succeeding **King Ruhly,** who was promoted to Sales Manager.

Don Patterson has been appointed sales representative for Michigan. He attended Wayne University, Detroit, after his discharge from the Army, where he served during World War II.

Bob Richards has been transferred to the Eastern territory as sales representative. He replaces Frank Jones who was promoted to Assistant Sales Manager.

Mr. Richards spent a number of years in the Army Air Corps, and attended Montana State College and Michigan State Normal. He was with Pittsburgh Plate Glass Company as sales representative prior to coming with Michigan Chrome & Chemical Company.

Henry S. Rondeau and the Cleveland Industries Company, 1935 Euclid Avenue, Cleveland, have been appointed representatives for Pennsalt's Corrosion Engineering Products in Ohio and northern Kentucky. This organization will be agents for Pennsalt's corrosion-resistant cement mortars and coatings for construc-

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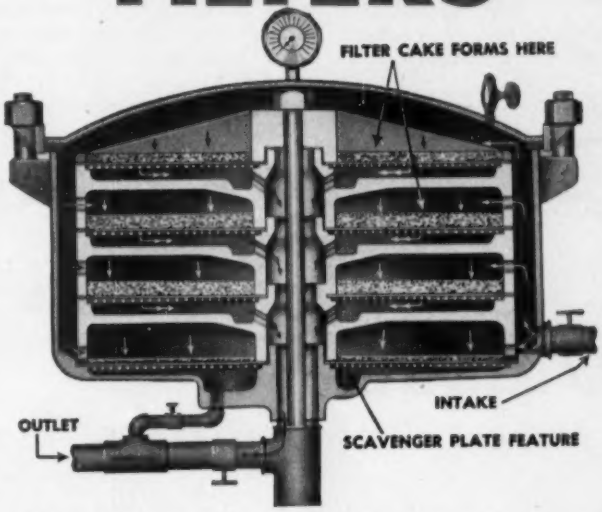
Forget your troubles with filter cake stability, cracking, slipping or breaking when you use . . .

SPARKLER
HORIZONTAL PLATE
FILTERS



The positive stability of the filter cake in Sparkler Horizontal Plate Filters gives a consistent uniform quality of filtration regardless of variations in pressure or flow interruption, even with complete shut down of the filtering operation.

No fibrous material is required to hold a pre-coat on the horizontal plates. Even a very thin pre-coat can be applied and a low density cake built up with low pressure filtering resulting in a greater flow rate than is possible where pressure is required to hold the cake in position.

Any kind of filter media, paper, cloths, or screens with any grade of filter aid can be used with maximum efficiency because the problem of cake stability is never a consideration with Sparkler Horizontal Plate Filters.

Fine sharp filtration is obtained right from the start and continued up to the end of the filtering cycle.

The filter cake built up on a Sparkler Horizontal Plate is always uniform in thickness and porosity over the entire plate. Flow is with gravity, and the filter aid is floated into position and distributed evenly over the entire surface.

This is why users of Sparkler Filters are free from filter cake trouble.

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SERVICE REPRESENTATIVES IN PRINCIPAL CITIES

SPARKLER FILTERS · SPARKLER FILTERS

tion, chemical and allied, petroleum and petrochemical, pulp and paper, primary and secondary metals and food industries in this territory.

Robert T. Dunlap, President of Great American Industries, Inc. (Meriden,

Thompson

Conn.), and **Hal A. Kroeger,** a founder of A. & H. Kroeger Organization, New York City management consulting firm, were elected directors to fill vacancies on the board of The Gerity-Michigan Corporation, Adrian, Mich. **J. Cary Thompson, Jr.,** a Director and heretofore Assistant Secretary, was elected Secretary. He succeeds **John F. Langs,** who will continue as the corporation's general counsel and a director.

Martin H. Smith, formerly of Hercules Powder Company, has joined the Technical Service Department of the Atlas Mineral Products Company.

Warren E. Scoville, Jr., has been appointed Assistant Manager of the Development Department of United States Rubber Company's plant in Passaic, N. J.

Mr. Scoville has been in the company's Development Department since graduating from Stevens Institute in 1934.

Dr. Max E. Bretschger, formerly vice-president of Buffalo Electro-Chemical

Bretschger

Company, Inc., has been elected president of the company to fill the vacancy created by the death of the late **Charles A. Buerk.**

Ed Mardorf of 27401 Markbarry Dr., Euclid 23, Ohio. has joined The Bullard Clark Company of Danielson, Conn., and Charlotte, N. C., as Sales Engineer.

Mardorf

Mr. Mardorf, formerly President of the Elson Abrasives Corporation, Cleveland, and a life-long resident of the Cleveland area, will devote his time primarily to the sale and distribution in Ohio of buffing and polishing wheels manufactured by the Williamsville Buff Division of the above-named Company.

Gordon E. Bouvier will manage the new Canadian offices for the Eclipse Fuel Engineering Company, of Rockford, Ill. The

Bouvier

new company, Eclipse Fuel Engineering Company, of Canada, Ltd., has been formed to handle sales and service on "Eclipse" products in Canada. The entire line of equipment manufactured for over 40 years by the Rockford company will be represented and serviced by the Canadian organization with offices at 705 Bloor St., West, in Toronto.

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CLEANING
WHITE
METALS

If you have trouble with:
BUFFING COMPOUND REMOVAL, SAFE ANODIC CLEANING, METAL WASHING MACHINE COMPOUNDS, OR SOAK CLEANING
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The right electrolytic cleaning compound for whatever purpose you may need is assured when you use a PERMAG cleaning compound.

While extremely adaptable to the various finishing processes, PERMAG compounds are designed to do a particular job.

White metals, whether for electrodeposition or other finishing, always come clean under PERMAG treatment. Our technical service staff will be glad to make recommendations on any cleaning problem you may have.

Write for your FREE Electroplaters Handy Pocket Size Manual on Cleaning Compounds.

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one glance *proves* there's no equal to H-VW-M Bias Sisalweev

See that weave? The sisal is cut *on the bias.* Every fiber is directed *toward* the cutting edge. There's no danger of whole strands flying off at high speed. Every Bias Sisalweev wears *evenly* and outlasts any other design.

You'll find a Bias Sisalweev ideal for heavy cutting down of drawn, stamped, or cast ferrous and non-ferrous articles. You can use it at high or low speeds—it's impossible to scorch at any speed or pressure. And, it's ventilated —24 air channels give extra cooling.

Bias Sisalweev is supplied either treated or untreated, but we recommend the exclusive H-VW-M HC, (heavy cut) treatment. This not only increases the rate of cut, but lengthens wear life and power to hold composition. And for buffing steel, you can't beat the combination of a Bias Sisalweev and H-VW-M 6-B-97 composition for heavy cut or 6-B-66 for medium cut with finer finish.

Bias Sisalweev is just one of many results of over eighty years of constant electro-plating and polishing development — a continuing policy summed up in H-VW-M Platemanship . . . your working guarantee of the best that industry has to offer not only in brushes and buffs—but in every phase of plating and polishing.

PLATEMANSHIP

PLATEMANSHIP — PLATING & POLISHING PROCESSES · EQUIPMENT · SUPPLIES

Further information on Bias Sisalweev is available on request.

Your H-VW-M combination — of the most modern testing and development laboratory — of over 80 years experience in every phase of plating and polishing — of a complete equipment, process and supply line for every need.

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SALES OFFICES: ANDERSON • BOSTON • CHICAGO • CLEVELAND DAYTON • DETROIT • GRAND RAPIDS • LOS ANGELES • MATAWAN MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH ROCHESTER • SPRINGFIELD (MASS.) • STRATFORD (CONN.) • UTICA

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INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

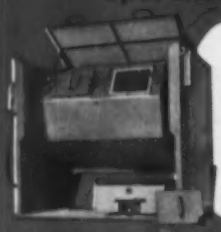
It's the Finish that Counts

ROTO FINISH

Roto-Finish COMPOUNDS AND CHIPS ARE MADE TO GIVE YOU THE PROPER FINISH ECONOMICALLY

There are other brands of materials that resemble Roto-Finish chips and compounds . . . but only Roto-Finish chips and compounds give you the *extra advantage* of continuous research by the company who originated the Roto-Finish processes. Roto-Finish chips and compounds are carefully manufactured so *you* obtain the best results on *your specific job*. To obtain the best results at the lowest cost . . . insist on ROTO-FINISH chips and compounds.

ROTO-FINISH puts your grinding, deburring descaling, polishing, britehoning or coloring operations ON A MASS PRODUCTION BASIS



SAVES MAN HOURS AND MONEY by eliminating hand finishing.
GIVES ABSOLUTE UNIFORMITY...in any quantity.
MAINTAINS PRECISION TOLERANCES.
CUTS FINISHING costs as much as 80%.
LOWERS INITIAL and MAINTENANCE costs.

ROTO-FINISH COST-FREE ENGINEERING SERVICE GUARANTEES RESULTS

Put the experience and facilities of Roto-Finish to work for you on *your special finishing problems.*

Send a few unfinished parts to us . . . plus a finished part as a guide. We *guarantee* that you will get the same results in your plant that we produce in our laboratory. There's no obligation.

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Trade Literature

L—300. Handy Reference for Defense Plants—Plant men concerned with defense production will find the recently revised booklet, "Houghton Products Meeting Government Specifications", a helpful reference in the manufacture of items to Federal requirements. The products meeting various specifications are conveniently listed under the following classifications: rust preventives, lubricants, cutting oils, metal working aids, and leather and synthetic rubber products.

Copies may be obtained by writing E. F. Houghton & Company, 303P W. Lehigh Ave., Philadelphia 33, Pa., or using Reader Service Card.

L—301. Plastic Processing Equipment Brochure—The Atlas Mineral Products Company, Mertztown, Pa., has issued a new spiral bound brochure containing reprints of technical papers on fabricated plastics in the plating industry along with plastics equipment reference sheets and an illustrated bulletin on rigid polyvinyl chloride material. Copies of this brochure are available. Use Reader Service Card.

L—302. Electroplating Large Complex Shapes—A reprint by The International Nickel Company, Inc., 4 pages, illustrated. It points out that the more modern plating plants, making the utmost use of chemistry, electrochemistry, plating "know how", are successfully electroplating nickel on large, complex equipment up to 700 square feet in area. For handling corrosive materials, heavy electroplated metallic coatings will supplement, or substitute for, clad metals, wrought metals and alloys not only as a means of conservation but, in many cases, as an economic measure. This is particularly true where a large number of pieces of the same size and shape are required. Design factors, welds, preparation and plating methods are discussed. For your copy use Reader Service Card.

L—303. Tygon Gasket Bulletin—The U. S. Stoneware Company has just issued a new bulletin, G-520, on "Tygon Corrosion-Resistant Gasketing". This 4-page, 2-color bulletin gives complete information on the basic compositions and physical characteristics of Tygon gasketing and where and how it is applied. Charts plus an excellent table on specific applications are also included. For your copy of this new bulletin, use Reader Service Card.

L—304. Automatic Plating Equipment Bulletin—A completely new bulletin on automatic rack type plating equipment is now available. Prepared by Fred-

You can make your Zinc Plating Operations more profitable with Du Pont "DUROBRITE"

Addition Agent 309

...ECONOMICAL

...EASY TO USE

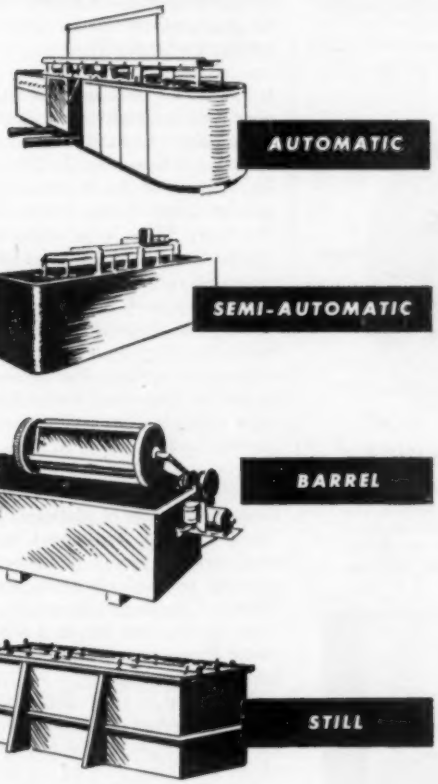
The advantages offered by "Durobrite" Addition Agent 309 can keep your zinc plating operations at peak efficiency. This economical agent assures uniformly bright, lustrous plate with the addition of as little as ⅛ of an ounce per gallon. This means increased output with the materials at hand and reduced production costs—no matter what type of unit or cyanide zinc plating bath you employ.

"Durobrite" plating baths have a wide, bright plating range. And they provide easy, economical control and maintenance under high production rates. In addition, the deposits produced with "Durobrite" feature high purity and uniformity . . . are suitable for subsequent passivating treatments and conversion coatings.

Be sure to investigate "Durobrite" Addition Agent 309 for low-cost bright zinc plating. A call to our nearest district office will bring prompt, practical advice from experienced technicians in the plating field. They'll be glad to discuss your specific problems with you and make "on the spot" recommendations to help you increase plating efficiency.

For further information and literature on Du Pont Plating Chemicals, contact your nearest Du Pont district office or send in the coupon below. E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

Equally effective in all these units:



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..THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Dept., Wilmington 98, Del.

Please send me complete information on Du Pont Plating Chemicals—properties, advantages and recommended procedures. I am interested in the following types of plating:

☐ Zinc Plating ☐ Tin Plating
☐ Copper Plating ☐ Cadmium Plating

*Name*_____ *Position*_____

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Trade Literature

eric B. Stevens, Inc., it gives complete descriptions and illustrations of their automatic rack type machines.

Many of the special applications that these machines are capable of handling such as heavy duty cleaning and pickling and automatic bright dipping are also illustrated. Copies of this new Stevens bulletin No. 61P may be obtained from Frederic B. Stevens, Inc., Detroit 16, Mich., or through use of Reader Service Card.

L—305. Barrel Finishing Portfolio—An informative discussion of barrel finishing procedures is now available, published by Wyandotte Chemicals Corporation, Industrial Department, Wyandotte, Mich. It includes in the discussion outlines of seven operations which can be performed in finishing barrels. Recommended procedures are given for the bulk finishing of parts made of 11 different kinds of metals. This plastic-bound Wyandotte Chemicals portfolio on Barrel Finishing is "No. 1 of a Series of Aids to Industry". For your copy use Reader Service Card.

L—306. Instrument Case Histories—Actual instrument case histories are featured in the latest edition of the widely read "Beckman Bulletin", external house organ of Beckman Instruments, Inc., South Pasadena, Calif. How a spectrophotometer reduced silicate analysis time is described along with a new flame photometry procedure that simplifies tetraethyl lead analysis. Among other features is the method for determining viscosity and color of glass with spectrophotometry. Copies of this case history issue may be obtained by asking for "BB-72". Address inquiries to Beckman Instruments, Inc., South Pasadena 1, Calif., or use Reader Service Card.

L—307. Demineralization and Silica Removal by Ion Exchange—To help explain one of the newer roles that ion exchangers are playing in industry, The Permutit Company, 330 W. 42nd St., New York 36, N. Y., has prepared a 28-page bulletin, "Demineralization Including Silica Removal by Ion Exchange".

This new bulletin, 3803P, describes the chief applications, principles of operation, design features, advantages, recommendations and specifications of Permutit's demineralizing and silica removal apparatus and synthetic resins. For your copy use Reader Service Card.

L—308. Electrolytic Grinding—An 11-page technical bulletin No. 526P—"Electrolytically Assisted Diamond Wheel Grinding of Cemented Carbide", authored by members of the Research and Development Dept. of the Norton Company, Worcester, Mass., is an evaluation of the "electrolytic grinding" method used on cemented carbides. Illustrated with figures, charts and tables the article concludes that diamond wheel grinding assisted by electrolysis is promising as a commercial method, that it does offer a means for conserving diamond bort. For your copy of this bulletin use Reader Service Card.

L—309. New Metal Processing Bulletins—"Annealing of Malleable Iron" and "Heat-Treating Equipment for Aluminum" are two new bulletins recently announced as available from the General Electric Company, Schenectady 5, N. Y. They are the first two in a new Modern Metal Processing series which will be released by the company.

Designated as GEA-5797, the 12-page, two-color booklet on the annealing of malleable iron employs photographs and diagrams to explain how to cut down overall costs and how to shorten annealing cycles. "Heat-Treating Equipment for Aluminum", designated as GEA-5912, is an 8-page, two-color brochure that describes the process of solution heat-treating, annealing, aging, and stabilizing of aluminum. For your copies of these bulletins use Reader Service Card.

L—310. Flashing Bulletin Board—A new bulletin board brings life to safety posters, plant messages, photographs and other material that may be quickly inserted between the two double glass panels of this new flashing bulletin board. Flashing approximately 15 times a minute it carries two separate messages that may be read from a wide angle. Full

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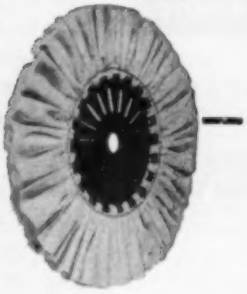
A C-20 flexible Contact Wheel will form itself to the shape of the work and permit the abrasive felt to polish contoured surfaces and F-26 Abrasive Belt Lubricant will increase belt life by preventing loading and glazing. Produces finer, smoother and brighter surfaces through lubrication.



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These famous long-wearing buffs run cool under all buffing conditions. Constructed of high count bias-cut cloth or sisal mounted on safe steel centers. Available in a wide range of densities and center diameters.

A complete line of buffing compounds in bar form as well as in liquid form for brush or spray application. Also Flex-A-Glu polishing wheel cements.

Our Laboratory and Sales Engineering staff would welcome the opportunity to be of help in solving your finishing problems.

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information may be obtained by writing to Industrial Products Company, 2826 N. Fourth St., Philadelphia 33, Pa., or through use of Reader Service Card.

L—311. Heavy Rhodium Electroplating—The first practical method for electroplating rhodium to thicknesses as great as 0.001 inch, thus imparting the properties of pure rhodium to base metals, is announced by Technic, Inc. of Providence, R. I. In the past, rhodium plating has been limited to thin, porous flash deposits of 1–10 millionths of an inch thick.

In announcing the new Technic method of electroplating rhodium to thicknesses heretofore unattainable, the company has issued a compilation of data under the title, "Electroplated Rhodium". Believed to be the most complete listing of electrical and physical properties of rhodium ever assembled for ready reference in one place, the Technic data sheet also details factors of corrosion resistance, hardness electroplated, electroplating specifications, and rhodium thickness requirements for different purposes. For your copy of the data sheet use Reader Service Card.

L—312. Temperature-Humidity Test Chambers Bulletin—Tenney Engineering, Inc., Newark, N. J., announces a new two-color 4-page bulletin on its standard line of temperature-humidity test chambers. Chambers covered in this bulletin can simulate temperatures from −100° F to +200° F and relative humidities from 20 to 95 per cent.

Specifications give data on chamber construction, performance characteristics and typical applications. Interior dimensions and temperature ranges for eight different standard model types are tabularized in a specification section. Copies of Bulletin TR can be obtained by use of Reader Service Card.

L—313. Pre-Tested, Standard Dustkop Dust Collector—How the dust from 27 grinding wheels in the tool room of a leading manufacturer of compressors is being controlled by a standard, pre-tested Dustkop dust collector is described in bulletin 637 issued by and available direct from Aget-Detroit Company, Dept. P, Ann Arbor, Mich.

Bulletin describes how time and money was saved in obtaining and installing the collector, and also gives the principal specifications of the Model 90N50 collector. For your copy use Reader Service Card.

L—314. Catalog Describes Cast Plastics—Optically clear rigid plastic sheets of COCOR CR-39, CP-1, and CO-3, as well as CP-2 UHF insulation sheet and rod, are featured in a new 8-page illustrated bulletin just published by Cast Optics Corporation, 1-P Post Road, Riverside, Conn., and now ready for distribution.

The catalog contains descriptions and tables of properties of four COCOR cast plastics, lists of features, brief fabrication instructions, and some of the accepted uses. For your copy use Reader Service Card.

L—315.—Lubricant, Drawing Compound, Metal Cleaner Catalog—Gilron Products Company, 6007-P Euclid Ave., Cleveland, Ohio, announces the completion of a new 8-page, 2-color folder of interest to persons engaged in all metal forming operations.

This new folder fully describes Drawcote, Gilron's new dry lubricant for use in drawing, forming and extruding operations. A brief description of some of Gilron's drawing compounds and metal cleaners is also included. For your copy of the catalog use Reader Service Card.

L—316. Pamphlet on Maintenance Available—R. S. Aries & Associates, 400-P Madison Ave., New York 17, N. Y., consulting firm of chemical engineers and economists, has released a new brochure entitled "The Problem of Maintenance Costs" by Mr. Jackson D. Leonard, senior associate of the Aries firm. This new pamphlet discusses the profits lost through poor and inefficient maintenance practices, and what companies can do to improve performance in this department. Mr. Leonard's work represents a modern approach to reduction of maintenance costs for the chemical process industries. This brochure is available free upon request. Use Reader Service Card.

L—317. New Booklet on Tin Scarcity—The plentiful supply of tin in Malaya and the vital role tin plays in the Free World are the themes of a 20-page, illustrated booklet in three colors, published for free

NEW and BETTER INSULATION

The improved BUNATOL Paste is perfectly adapted for use on plating racks and on many other forms of equipment where its use will save time, cost and rejects.

Plating racks insulated for every kind of service; for coating anode baskets; conveyor hooks; material handling equipment; grids; dipping baskets; fans and fan housings; acid pails; buss bar shields; and even for making castings in simple molds without pressure; are some of the everyday uses of the improved BUNATOL Paste No. 1002.

BUNATOL Paste made in Red or Black has all the new improvements in plastisol manufacture plus the famous one-coat BUNATOL Primer which provides that continuous and lasting adhesion which permanently binds the thick Paste coating to the object. Superior performance by any method of comparison. Provides the last word in low cost insulation with less time and labor cost.

No. 1002 heat curing Paste is an extremely tough leather-like material (of any desired thickness) that will withstand all electroplating chemicals such as strong and hot alkalies and acids, and the usual cleaning solutions. Oftentimes the insulation will outlast the plating rack. It's 100% solids so there is no loss from evaporation.

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high corrosion resistance
paint base
bright finishes
final finishes
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TODAY for finishing ZINC, CADMIUM, ALUMINUM, CUPROUS METALS
WANT CORROSION RESISTANCE? Iridite will give you better-than-specification protection against corrosion.
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WANT EYE-APPEAL? Iridite can give you a variety of finishes, depending upon the metal being finished . . . from clear and sparkling bright or military olive drab, to attractive dyed colors.
BEST OF ALL, any Iridite finish is economical and easy to apply.
for example: IRIDITE (AL-COAT) REDUCES NEED FOR ANODIZING
Simple chemical dip; immersion time only 10 seconds to 2 minutes; no sealing dip; color is clear or yellow depending upon your requirements; salt spray resistance equivalent to 20 to 30 minutes of anodizing, eliminates need for costly racks and electrical power.
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For Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Brighteners.

nationwide distribution by The Malayan Tin Bureau, Washington, D. C.

Stressing tin as a key component of many bearing metals and as the prime ingredient of solder, the booklet cites the fact that almost all of the 250,000 manufacturing plants of the United States, employing more than 14 million people, depend upon tin directly or indirectly. A free copy may be obtained by writing The Malayan Tin Bureau, Department 80, 1028 Connecticut Ave., Washington, D. C.

L—318. Transmission Systems for Automatic Process Control—A new catalog now ready for distribution describes completely the pneumatic, magnetic, electric, electronic, and electronic-follower transmission systems for use in measurement and control of flow, pressure, liquid level, viscosity, and specific gravity.

The catalog is profusely illustrated containing performance characteristics and schematic diagrams of the various systems, Copies of catalog T-50 may be obtained free of charge by writing Fischer & Porter Company, 7250-P Jacksonville Rd., Hatboro, Pa., or through use of Reader Service Card.

L—319. Report on Demineralized Water—The Research Department of the Barnstead Still & Sterilizer Company, 228 Lanesville Ter., Forest Hills, Boston 31, Mass., has prepared an informative, 11-page report on the "Uses For Demineralized Water" together with a Water Analysis Study. This report gives comprehensive information on the uses of demineralized water and points up its advantages in manufacturing and processing operations. To get your copy of these reports use Reader Service Card.

L—320. Molybdenum Disulfide Lubricant Bulletin—Bulletin 95, a new catalog on Molykote Lubricants which includes complete technical information on all standard industrial grades and compositions, is now available from The Alpha Corporation, Greenwich, Conn.

A feature of the new 8-page, 2-color catalog is the inclusion of a detailed description of this new principle in lubrication and applications in which the compound can be expected to do a superior lubricating job. For your copy use Reader Service Card.

L—321. Chromalox Electric Heater Catalog—Chromalox electric comfort heaters of every type, size and rating are described and illustrated in a new 8-page catalog. A quick selector chart shows how to calculate heat requirements for given areas and types of building construction.

The catalog lists 75 different models of forced air, convection and radiant heaters in capacities of ¼ to 100 kilowatts. In this wide selection are heaters suitable for heating anything from a small office to a complete building, or semi-exposed areas,

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MERSOSTRIP

A time-saving tank-type alkaline paint remover

SPEEDIER Action!

LOWER Cost!

It's Accelerated!!!

- Mersostrip is a complete, balanced product — simply add it to water
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- Non-dusty, free-flowing, 100% soluble, and free-rinsing
- Economical — shorter stripping time . . . lower concentrations . . . longer life

Here for the first time is a single product that gives you fast, economical paint stripping with alkaline materials dissolved in water. MERSOSTRIP gives you *much* faster and more complete stripping than is possible with ordinary caustic soda-type paint removers.

With MERSOSTRIP you use lower concentrations — reduce stripping time — get real cost-savings. And MERSOSTRIP works wonders where paint stripping and cleaning must be carried out in the same tank. Try amazing new MERSOSTRIP. Mail the coupon for data.

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With complete control of the sequence plus the conveyor handling of the parts, a Meaker machine gives greater production, reduced costs, uniform predetermined quality and less turnover in personnel due to better working conditions. Meaker equipment is tailored to the job requirements in plating, anodizing, pickling and cleaning, bonderizing or other processes involving a sequence of washes, rinses, and dips. Get full particulars from The Meaker Company, 1629 South 55th Avenue, Chicago 50, Illinois.

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MEAKER PRODUCTS

Meaker Return-Type Automatic Plating Machine

PLATING EQUIPMENT FOR OVER 50 YEARS

Trade Literature

such as shipping docks, box cars and the like where any other heat is ineffective. For your copy of catalog D-52 write to Edwin L. Wiegand Co., 7686 Thomas Blvd., Pittsburgh 8, Pa., or use Reader Service Card.

L—322. Vinylite Resins Booklet—The latest technical information on specifications, formulations and uses of Vinylite Resin VMCH as a surface coating is presented in Technical Release No. 12, a new 16-page booklet published by Bakelite Company, a Division of Union Carbide and Carbon Corporation. Addition of plasticizers, stabilizers and solvents and their effects on resin VMCH are discussed in the pamphlet. Several applications are also described. Copies of this booklet may be obtained by writing to P. D. Masson, Bakelite Company, a Division of Union Carbide and Carbon Corporation, 300 Madison Ave., New York 17, N. Y., or through use of Reader Service Card.

L—323. New Type Hi-Temp Oil—A new lubricant for use at temperatures of 500° F and over—Hi-Temp Oil 303—which is light enough to be fogged easily in automatic lubricators yet provides high load carrying protection, has been announced by E. F. Houghton & Company, Philadelphia. This recently developed "hot-spot" lubricant combines molybdenum disulphide with a synthetic base and a pure, low-carbon-content petroleum oil. These properties impart exceptional lubricity, high resistance to heat breakdown and reduce carbon build-up to a minimum on bearings exposed to elevated temperatures. Further information on this product is contained in the recently revised "Hi-Temp Oils" leaflet, available through use of Reader Service Card.

Methods for Treating Metal-Finishing Wastes are evaluated in the latest manual of the industrial waste series being published by the Ohio River Valley Water Sanitation Commission. Prepared by the Metal-Finishing Industry Action Committee of the Commission, this 72-page illustrated report also describes the procedure for a company to follow in determining the process best suited to its needs. Techniques, reactions, and design considerations as well as advantages and weaknesses of each method are provided. Copies of the manual, priced at $2.00, may be obtained by writing to the Commission at 414 Walnut St., Cincinnati 2, Ohio.

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Rounds out our Anode Line

This addition to the Wagner anode line really "rounds out" your choice. Our new Iso-Cast Copper Oval fills a niche beside those standards of the industry, Flat-Top and Lectrocop Copper Anodes. In this cast oval, we offer you the purest form of metal, electrolytic copper, in one of the most common forms used by the plating world. We mold the Iso-Cast Copper Anode under the strict controls which guide our entire anode production in order to assure you of a finished product of the highest degree of purity.

We want you to know the story of the growth of Wagner service to consumers of anodes and other plating and polishing materials and equipment. It's more than a mere recitation of increased production facilities; it's a record of continual interest in our customers' problems, of achievements in devising better materials and methods for metal finishing. Our Iso-Cast Copper is simply another progressive step. Our representatives all over the country are anxious to keep you up to date on developments and are fully qualified to give you service. If you'd like further information on Wagner services, please fill out coupon below and attach to your letterhead.

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Equipment and Supplies

E—324. New Greaseless Composition—The Hanson-Van Winkle-Munning Company, Matawan, N. J., announces a new buffing and polishing composition known as "Acme Greaseless Composition". The new material adheres strongly to the wheel face to form a heavy, fast drying "head" which does not fly off and remains firm even in the warmest weather. There is no waiting for an application to set. The composition, featuring consistently sized abrasive, may be used on brushes and buffing wheels and for hand buffing and is available in aluminum tubes and in foil-lined cardboard cartons.

For further information on this and other buffing and polishing compositions described in Bulletin CP-100, use Reader Service Card.

E—325. ROHCO Currentester—According to an announcement by the R. O. Hull Company, this equipment is to plating rectifiers what the Hull Cell is to plating baths. Hidden troubles or defects in rectifiers, not shown by any visible effect, can cause poor plating just as impurities or wrong composition of a bath can be the cause of rejects and poor plating. A few examples of these defects are poor connections, one or two overloaded phases, one phase out, electrical leakage, phases not in balance, excessive ripple, etc. Rectifiers should have full-wave rectification for certain plating baths—many are only half-wave. All these and many more electrical factors are easily determined with the Currentester, which is designed specifically for plating rectifiers. Only a few controls and two clips to busbars are required to give a television picture which, by comparison with numerous figures, shows the exact type wave form of the current being tested. For additional information use Reader Service Card.

E—326. Boltaron Pipe Fittings—H. N. Hartwell & Son, Inc., Box 25P, Boston, exclusive distributors of rigid non-plasticized Boltaron 6200 Polyvinyl-Chloride

announces the development of threaded I.P.S. pipe fittings (tees, 45 and 90 degree elbows and couplings) molded of this amazing new corrosion-resistant material.

These fittings, in ¼ to 2 inch sizes, are now carried in stock for use with Boltaron pipe for best results in overcoming corrosion problems. Pipe in sizes to match is available in 10 and 20 foot lengths and can, of course, be threaded using ordinary pipe dies. For additional information use Reader Service Card.

E—327. Phosphoric Acid Cleaner—Klem Chemicals, Inc., 14403 Lanson, Dearborn, Mich., announces a phosphoric acid cleaner in concentrate form for ferrous metals. Designated as "Rust-Sol No. 123", this cleaner can be applied either by brush-on or immersion methods and rinsed off with clear water.

It dissolves all surface salts, rust, scale, etc., from production pieces, neutralizes and activates the surface with a slight etch and iron phosphate coating which makes an excellent base for paint. For additional data use Reader Service Card.

E—328. Portable Gear Head Mixer—Standard Electric Manufacturing Company, Inc., has recently developed a new portable 1/3 hp gear head mixer specially designed for mixing either more viscous liquids or larger quantities of less viscous liquids. A ¾ inch diameter 48 inch long stainless steel shaft is removable and interchangeable with other size shafts to fit individual requirements. For additional information, write Standard Electric Manufacturing Company, Inc., Dept. P, West Berlin, N. J., or use Reader Service Card.

E—329. Infra-red Meter for Radiation Work—A new infra-red meter designed to measure radiant-energy intensities up to 10 watts per square inch has been an-

BETTER COMPOUNDS *mean* MORE PRODUCTION *and* INCREASED PROFITS

Thirty years of experience developing and furnishing Polishing and Buffing Compounds to the Automobile Industry and hundreds of allied metal working firms entitles us to solicit the opportunity of working on your polishing and buffing problems.

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Important New "Tool" For The Metal Industry . . .

B&A FLUOBORIC ACID

While the Potentialities of Fluoboric Acid have long been known, only recently has Industry begun to recognize the multiple advantages this product offers in many fields. Its physical and chemical properties make B&A Fluoboric Acid of particular value in numerous metal cleaning and finishing operations.

Some of These—and other important uses—are high-lighted below. Perhaps B&A Fluoboric Acid holds equal promise in *your* operations. For further information, check applications that interest you and return coupon clipped to your company letterhead.

SOME IMPORTANT USES FOR FLUOBORIC ACID

• ***Metal Cleaning and Pickling***—to remove oxide film and smut from many metals. For example: for cleaning aluminum before spot welding; cleaning soldered joints before silver, copper, nickel or brass plating; dipping lead and lead alloy parts such as slushing castings, stereotype metal and bearing metals; removing light oxide film from steel before plating; cleaning aluminum or zinc die-castings before copper or brass plating; cleaning zinc after stripping; pickling tin before plating with copper or nickel.

• **Metal Finishing**—as a matte pickle for zinc; satin dip for brasses and bronzes; plating bath control where metal fluoborate solutions are used.

• **Electropolishing of Aluminum**—to produce mirror-like surfaces such as those on light reflectors.

• **Dissolving and Stripping Metals**—effective with an unusually wide range of metals; has particular merit where other acids are ineffective—as in stripping nickel and silver from racks, removing excess solder, etc.

• **Other uses:**
As an Electrolyte for Low Temperature Batteries.
With Tin Fluoborate for Sensitizing Plastics Prior to Plating.

SPECIAL!

Now Also Available in New 13-Gallon Plastic Carboy

In addition to standard 125 lb. rubber drums, B&A now offers Fluoboric Acid in the same revolutionary new plastic carboy introduced last year for its reagent Hydrofluoric Acid. This carboy provides many important advantages . . .

Purity Protected—Product quality is safeguarded by inert polyethylene bottles.

Strong and Sturdy—Reduce handling and storage hazards. Bottle molded of tough, resilient, shatter-proof polyethylene; enclosed in weather-resistant jacket.

Economical—Save on freight. 13-gallon carboy has only 26 pound tare weight.

Compact—Store more acid in less space. 13-gallon cylindrical carboy is only 15 inches in diameter, stands 34 inches high.

Easier to Open and Pour—Screw-type plastic cap plus special pour-clean bottle lip makes opening, pouring, and reclosure easy; safeguards against spillage.

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FINE CHEMICALS

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GENERAL CHEMICAL DIVISION
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Please send me further information on B&A Fluoboric Acid for uses checked.

☐ Metal Cleaning and Pickling ☐ Metal Finishing ☐ Electropolishing of Aluminum

☐ Dissolving and stripping Metals ☐ Other uses _____ (please indicate)

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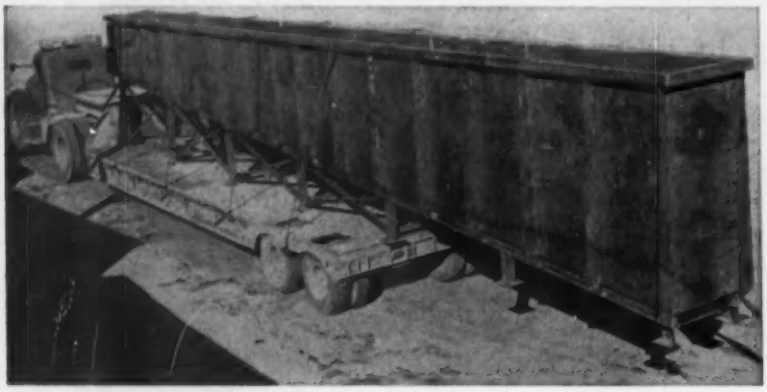

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Stresses on the welds in this tank as it pounded over the highways were terrific. But the welds showed no distress. Stortswelding is like that—full size, full strength, dependable. It is the kind of welding that will give all of your tanks long life utility.

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Equipment and Supplies

nounced by the General Electric Company's Meter and Instrument Department. Designated as Type DW-69, the new G-E meter is especially suited for determining in a matter of seconds the intensity of high range, radiant-energy sources and for studies of infra-red radiation effects concerning absorption and transmission properties of materials. The pocket-sized instrument is inexpensive and its operation is simplified because no separate thermopile or other accessory equipment is needed. For additional data use Reader Service Card.

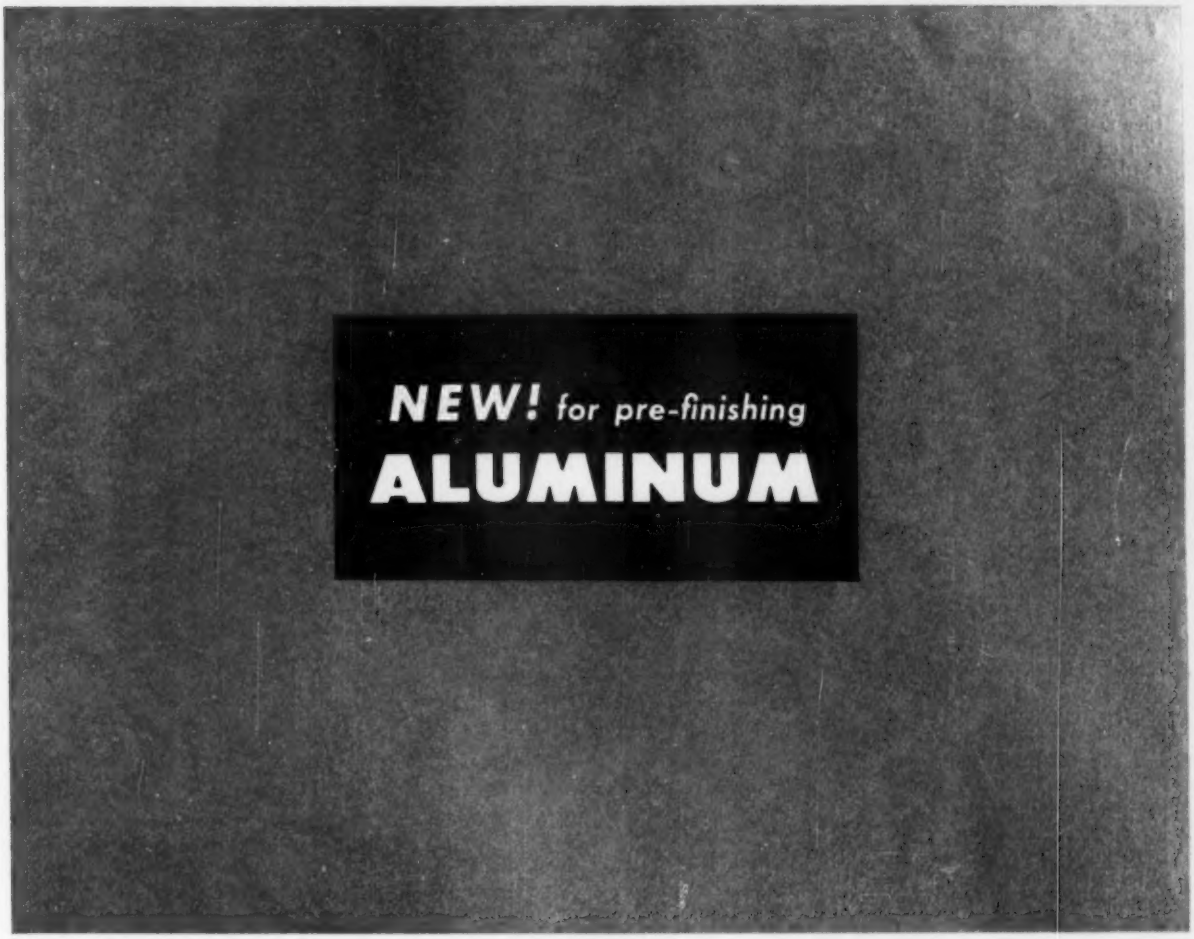
E—330. Abrasive-Belt Grinding Sharpens Carbide Tools—A new method of sharpening tungsten-carbide cutting tools, without a diamond wheel, costs approximately 2/3 less per tool sharpened

than the conventional diamond-wheel method, and produces a longer lasting cutting edge on the tool. A result of cooperative engineering between Behr-Manning Corporation of Troy, N. Y., and Fenlind Engineering Company of Rockford, Ill., the machine for the new method uses as a grinding element a coated abrasive belt that travels over a cast iron contact wheel specially formulated for extreme hardness. The new development removes the urgent need for diamond grinding wheels now in critically short supply. For additional information use Reader Service Card.

E—331. Alkalume Deoxidizing Process—A new process, used in preparing aluminum surfaces for welding, has been announced by Northwest Chemical Company of 9310-P Roselawn, Detroit, Mich. The new process removes all soils and oxides without harming metal, thereby reducing surface resistance to a value of 0 to 10 microhms. The manufacturer states that "a resistance of 10 to 20 microhms will persist for many days without reoxidation".

In addition to eliminating mechanical cleaning operations such as the use of rotary wire brushes, the Northwest method assures more perfectly formed welds, free

MORE FACTS ON GETTING "A BETTER START FOR YOUR FINISH"



PENNSALT NOW OFFERS A COMPLETE "PACKAGE"

Five specialized products—three brand new—for preparing aluminum prior to anodizing, chromatizing, or other finishing methods

Here's a versatile new group of materials that will be of major interest to everyone concerned with the finishing of aluminum. One or more of these outstanding products can help finishers do a faster, safer, more economical, and considerably better job—on any grade or alloy of aluminum, and in conjunction with any type of finishing.

First of the three new products in this "package" is **Pennsalt Cleaner A-27**—a mild, non-etching aluminum cleaner that removes soils and marking inks without attacking the metal. Even when allowed to dry on the work, it will not streak or stain. Yet this superior cleaner costs the same as or less than competitive cleaners.

Second in the group is Pennsalt Cleaner AE-16—a new non-scaling, non-sludging etchant that produces an exceptionally uniform satin etch. AE-16 solutions stay in balance, are easy to control, and work fast. Tank cleaning with AE-16 can be done with just a stream of water—no more rock-like scale that requires hand-chipping.

Third new product is Pennsalt Aldox—a powdered acid-type desmutter and deoxidizer. Aldox completely replaces nitric acid in these jobs—gives you an easy-to-handle, safe powder which doesn't produce irritating fumes. Aldox desmuts to give a brighter surface than acid; it deoxidizes to provide a low SCR for spot welding.

The two time-tested cleaners which complete the "package" are **Pennsalt Cleaners 85** and **MC-1**—recommended for use wherever excessive grease, dirt, or an uneven oxide film must be removed before etching the aluminum.

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from cracks at a worthwhile saving in time and costs. For additional information on this process use Reader Service Card.

E—332. High Pressure Blower—A high pressure blower that quickly removes fumes, smoke, dust, sawdust and obnoxious odors is being offered by Standard

Electric Manufacturing Company, Inc., West Berlin 12, N. J. The precision made, all-aluminum, high quality blower moves up to 450 cubic feet of air per minute. For additional information use Reader Service Card.

E—333. All Steel Work Bench—The latest all steel work stands designed by Industrial Bench and Equipment Manufacturing Company, Inc., 97-P South St., New Britain, Conn., feature many new strengthening developments.

Trays are designed to render stiff and substantial support. Forward edges are turned down to afford easy access for cleaning. Gussets are welded to the corners by which trays are bolted to uprights and given additional support. All corners and edges are smooth. Industrial now makes 8 styles to choose from. For additional data use Reader Service Card.

E— 334. Improved Dipblack Process—Special Chemicals Corporation, 30-P Irving Pl., New York City, announces new, improved features in their Dipblack process resulting in faster production, greater economy and remarkable uniformity on all types of ferrous metals. Dipblack is a simple, inexpensive immersion black oxide finish developed during the early part of World War II.

The improved process will produce a uniform, rich black finish on any assembled unit consisting of different types of iron and steel (mild carbon and spring steel). No change in processing is necessary due to Dipblack's compatability with all types of iron and steel.

Simple control of the solution is afforded by Dipblack Colortrol and Dipblack Anti-Spray. Colortrol, a specially prepared replenishing salt, maintains the solution in proper balance, insuring against off-color deposits, and assures a lustrous, uniform fine black finish on all ferrous products. Anti-Spray, an exclusive inhibition agent, protects workers and keeps solution from running down outside of tank. For additional data on the new process use Reader Service Card.

E—335. Foamed Styrene-Metal Adhesives—The Atlas Mineral Products Company announces the availability of adhesive systems for bonding foamed styrene to metal or other surfaces. The adhesives are available as liquids or mortars which can be sealed by pressure contact to secure exceptionally high bond strengths. These products are distributed under the trade names, Amphesive 801 and Alfane.

E—336. New Fluid Agitator—The TurboTube Agitator was specifically designed by Chemineer, Inc., 511-P W. 2nd St., Dayton, Ohio, to meet the demand for a top-entering agitator which would have the hydraulic advantages of a side-entering

unit. The physical disadvantages of heretofore conventional equipment—such as a submerged stuffing box; costly installation; and inaccessibility for maintenance—have been eliminated.

The TurboTube Agitator was originally designed to meet the need of the steel industry for consistent and thorough agitation of long rectangular pickling tanks. It has equally important applications in fields where tank geometry does not allow optimum agitation with standard methods or where a submerged stuffing box cannot be tolerated. For additional information use Reader Service Card.

E—337. Machine Bonds Lead to Steel or Copper—Knapp Mills, Incorporated, of New York, has announced an entirely new and highly versatile automatic machine which will produce a perfect chemical bond between lead and steel. In one day one small machine will clad a steel surface that would require 8 to 10 man-days to cover by outmoded hand techniques, according to the company.

Such machines will chemically bond a strip of lead up to 12 inches wide by ¼ inch thick to prepared steel. The operator can control the width and thickness of the lead cladding by regulating the speed of the machine and by spreading or narrowing the two cladding heads with which it is equipped. For additional data use Reader Service Card.

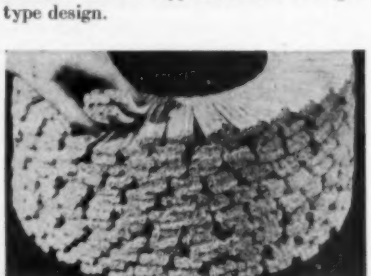
E—338. Bench Model Tumbling Barrel—The Tumbling Sales and Service Company, 400 King St., Greenwich, Conn., announces the availability of the Tesco Universal, Model B, Tumbling Barrel. It is a bench model which provides the latest approach to the problem of barrel finishing tiny pieces such as watch parts, surgical needles, pinions, and many other types which would be lost in any barrel of conventional size.

Model B-1, a constant speed unit, can be supplied in any one of several different speeds to fit the requirements of the job. Model B-2, a variable speed unit, has a Lovejoy Drive which provides an infinite range of speeds from 15 rpm to 45 rpm.

These are truly universal barrels. They can be operated either with closed, horizontal drums, or with open end, tilting drums, and the tilt can be adjusted to any angle between 45° and 135°.

Five standard sizes of interchangeable drums are available—three horizontal and two tilting—and special drums can be built to customers' specifications. Changing of drums is easy and can be done in less than a minute. For further information use Reader Service Card.

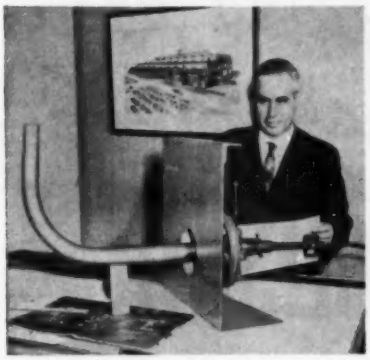
E—339. New Type Sisal Buff—Entirely new to the polishing and buffing operation, the Geo. R. Churchill Company, Inc., 7526 Fayette St., North Quincy 71, Mass., announces a new type sisal buff of finger-type design.



It is called the "20-RD Sisal Buff". A second entirely new feature of this buff is that only a specially processed, tightly twisted, first quality sisal twine is used, which is fabricated into each buff finger in such a manner that only the raw ends of the sisal fibres are in contact with the work. The advantages of this construction are much faster cutting action and longer wearing qualities. This new sisal buff is produced in all sizes from 6 to 18 inch diameters, for both hand buffing and

automatic machines. For further information use Reader Service Card.

E—340. Ferrolum Gas Heater—Flame Thrower for Industry: Shown on the drawing board is the first pilot model of a Ferrolum lead clad steel direct fire gas burner for heating corrosive acid solutions. Traugott Tschudi, chief design engineer of Knapp Mills, Inc., New York,



designed this burner which admits the gas flame through the wall of a tank into the Ferrolum tube which is immersed in the solution.

So efficient is this type of heating, that relatively small installations will heat large volumes. Physical strength and good heat transfer properties necessary in equipment for heating corrosive liquors, such as sulfuric, chromic, phosphoric acids, sulfate solutions and the like are found in the newly developed Ferrolum immersion-type gas heater. Ferrolum lead clad steel combines the strength of steel with the ability of lead to resist the corrosives under discussion. For additional information on the new heaters use Reader Service Card.

E—341. Metal Marking Ink—John P. Nissen, Jr., Company, Glenside, Pa., are offering a fast drying marking ink that has wide use where materials are to be marked permanently since the ink will not chip or peel and is unaffected by heat and weathering. Tests have been conducted which show that marks made on metal with the Nissen marker are still as good as new even after two years of continued weathering, rough handling and hard usage. The ink is ideal for marking rough castings, bar stock, machinery, jigs, tools, dies, fixtures and plates.

The low cost marking ink obtainable in six different colors is easy to apply from a burst proof tube with a ball point attachment specially designed for marking rough materials. For additional information use Reader Service Card.

E—342. Electronic Repeat Cycle Timer—An electronic repeat cycle timer suitable for regulation of automatic machinery, sampling, valve pacing and heat sealing as well as laboratory testing of electroplating solutions is available from G. C. Wilson & Company, 2-P N. Passaic Avenue, Chatham, N. J.

The timer is designed so that "on" cycles are adjustable from 0.2 to 200 seconds and "off" cycles range from 0.1 second to 1 minute. The unit is supplied in a sloping steel front cabinet, 6 x 6 x 6 inch for operation on 105–120 volt, 60 cycle a-c. Output is supplied to a double pole double throw relay for non-inductive loads up to 10 amperes at 115 volts or 2 amperes at 460 volts. Relay contacts are wired to a plug or a terminal strip to facilitate installation. For additional information use Reader Service Card.

E—343. Generator Motor Cleaner—A new solvent that cleans electric motors and generators while they are still assembled has been announced by The Shaler Company, Waupun, Wis. This new product, called Shaler Generator-Motor Cleaner, is listed under the Reexamination Service of Underwriters' Laboratories, Inc.

According to the company, motors and generators can be cleaned two different ways, with this solution: A motor can be completely submerged in the cleaner, then plunged into electric current and allowed to run for from three to five minutes. The motor is then removed from the dip tank and dried with compressed air, or the cleaner may be sprayed into the intake side of a motor, while it is in operation.

Motors which have been accidentally submerged in water as a result of fires, flood, etc., may be cleaned without "baking". For further details use Reader Service Card.

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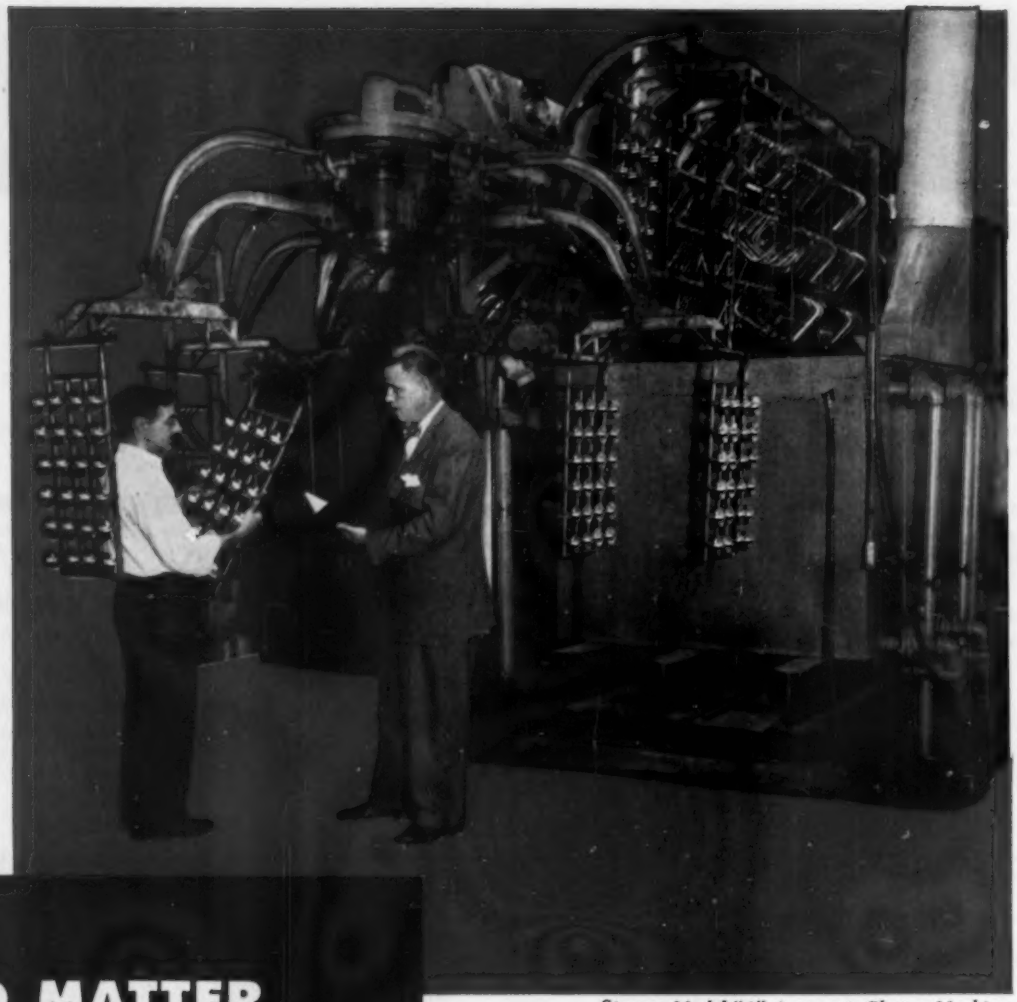

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plating

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This month's cover photo is a view of the Sterling Chemistry Laboratory at Yale University, New Haven, Conn., where the work on Research Project No. 10 is being conducted.

Photo, courtesy of J. A. Varrone, New Haven Camera Club.

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Editorial

Let's Enlarge The Proceedings . . .

THE A. E. S. IS MOVING forward in its value to the industry it serves and to you as individual members. The active and constructive participation of your delegates at the recent Interim Meeting in Columbus is ample proof that the Supreme Society is on the march. The voice of that meeting and its echo were clear—we all want and need a better publication to serve as "the mouthpiece" of our Society.

As you know, we now have two publications and two formats—PLATING and PROCEEDINGS. Each has served a very cherished role in the tradition and growth of our Society. PLATING, with its 12 monthly issues, by nature plays a more temporary role than it should. Its technical value demands that it should be found as a bound volume among your other cherished books, rather than stored as loose monthly issues which usually find their way to the attic or an out-of-sight bookcase. We feel that a change in our publication policy is desirable, so that each member will receive the entire Supreme Society's published technical material in one handsome bound volume shortly after the beginning of each new year—in addition to the monthly issues of PLATING now being received. This will permit the publication of an enlarged PROCEEDINGS with the PLATING format, containing all the convention papers as usual and, in addition, all the technical papers published in PLATING. The style, including frontpiece, index and Society information as found in the present PROCEEDINGS will be retained.

Since under this plan the Society's publications will be entirely in one format, extra copies of the technical papers in PLATING will be printed each month and accumulated for inclusion in the bound volume along with the convention papers. This procedure will result in sufficient savings to give each member this bound, enlarged volume at no extra cost—a wonderful bargain for all members of the Society.

It is hoped that you will encourage your branch and your delegates to express themselves favorably with respect to this expansion of publication policy at the Philadelphia Convention in 1953, so that each member will receive the enlarged bound volume of the new PROCEEDINGS in 1954.

Ralph A. Schaefer

FOR THE EXECUTIVE BOARD

The use of rectifier units to supply DC for electroplating, anodizing, etc., has increased rapidly during the last ten years. It has been estimated that over half the amperes now used for metal finishing processes are supplied from rectifier units.

This article describes the manufacture of selenium rectifier cells and stacks and concludes with a brief description of complete power supply units incorporating selenium stacks.

SELENIUM RECTIFIERS FOR ELECTROPLATING

F. A. WAELTERMAN* AND L. W. REINKEN†

Metallic Rectifiers

The electrical resistance of most conductors composed of a single element or even of more than one element is independent of the direction of the current. There are, however, physical and chemical combinations of elements—copper-cuprous oxide junctions, certain metallic sulfides, selenium, etc.—in which electrical resistance depends on the direction of the current flow. These combinations are said to exhibit asymmetric conductivity. This is the essential characteristic of all metallic rectifiers.

Although metallic rectifiers may be considered rather recent developments, selenium rectifiers especially, their asymmetric conductivities have been known for a long time. There are few occasions in the history of science when a discovery was developed so thoroughly, promptly forgotten, only to be rediscovered fifty years later. The rectifying property of selenium was a secondary observation of 19th century scientists investigating its photoelectric properties. In 1877, W. G. Adams and R. E. Day reported both phenomena in the Proceedings of the Royal Society. Shortly thereafter, Walter Siemens, a member of that most inventive family of Europe, confirmed these findings. By 1883 Charles Fritts of New York had produced a selenium rectifier astonishingly similar to the modern-day product.

Although these discoveries aroused academic interest, and led to hundreds of investigations of the properties of selenium, little practical application was made of them at the time. The commercial development of its rectification and photoelectric properties did not materialize until 1928.

Selenium Metallic Rectifiers

It is difficult to credit any individual or group with the rediscovery of the selenium rectifier. It is easier to credit its rediscovery to the existing need. For a given capacity, selenium rectifiers are lighter in weight and smaller in size than other metallic rectifiers. Their efficiency is higher over a wide range of loading, and their performance is most uniform within a wide band of temperatures.

The basic selenium rectifier is very simply constructed. Essentially it consists of a layer of selenium between two metallic contacts. The function of one contact is to make connection to the selenium with as low a resistance as possible. This is satisfied, along with a requirement for mechanical support, by applying a selenium layer (0.0001–0.005 inch [2.5–125 microns] thick depending on the method of application) to a prepared metal base which is called the baseplate or back electrode. Originally, steel was used as the base-

*Vickers Electric Division, St. Louis, Mo.
†Green Electric Company, Inc., New York, N. Y.

plate material, but it has now been replaced by aluminum because of its lower weight. Aluminum also has a higher resistance to corrosion than steel, which is of particular importance in electroplating equipment because of the severe atmospheric conditions in which such equipment must work reliably. Depending on cell size, the baseplate thickness ranges from 0.02 to 0.06 inch (0.5–1.5 mm).

The other contact, called the front electrode, or counterelectrode, generally consists of a metal or alloy which is sprayed or evaporated on the selenium surface. It is at the junction of this contact and the selenium that the property of asymmetric conduction is confined and developed. Since this nonlinear junction, termed the barrier layer, is the critical component in determining rectifier performance, it is often considered as a separate entity divorced from the selenium and the front electrode. Although it is debatable whether such a layer exists physically, this viewpoint is further enhanced because of the practice in modern selenium rectifier production of introducing an artificial layer between the selenium and the front electrode. This artificial barrier improves the natural nonlinear junction so that the rectifier cell may operate at a higher applied voltage. (The current rating of a selenium cell is primarily a function of its rectifying area and the degree of cooling provided; the voltage rating, however, depends on the physical and chemical properties of the materials used, the barrier treatment, and the manufacturing processes.) The production of selenium rectifier cells is more of an art than a science. Each manufacturer has his own processes and methods for producing selenium cells, and these treatments are classed as trade secrets. Nevertheless, some interesting facets of selenium-rectifier production can be noted. Figs. 1–6 illustrate a few of the many steps involved in this specialized activity of selenium-rectifier production.

Selenium Cell Manufacture

Fig. 1 shows a sandblasting machine used in one step of the preparation of the baseplate material. Aluminum strips, previously cut to size and chemically cleaned, are roughened to provide a good bond for the application of other coatings. These coatings not only prevent any undesirable rectifying action between the aluminum and the selenium layer which is applied later, but also assure a sound, low-resistance connection at this point.

Fig. 2 shows a section of the chemical laboratory where independent checks are constantly being made on the quality and purity of not only the raw materials, but also of these materials as they pass through various steps of the manufacturing process. For example, the selenium is analyzed at three different levels. First, its composition as it is received from the refinery is checked. Although this selenium is sufficiently pure to pass the requirements for chemically pure selenium it is further processed to remove any unwanted

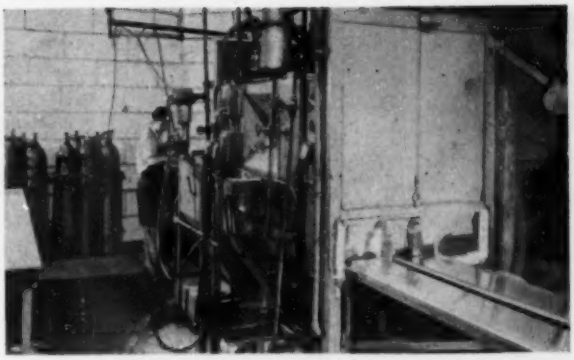

Fig. 1. Sandblasting unit used in the preparation of baseplates

impurities. Quality-control tests are again made for a second time. Finally, the selenium is deliberately contaminated with known additives (rare earth halides such as cerium iodide) in controlled amounts. This seemingly unusual step is necessary for rectifier performance of optimum uniformity; absolutely pure selenium will not exhibit the required property of asymmetric conductivity. After this step, the selenium is carefully analyzed for a third time, because the uniformity and stability of the final cells depends largely upon the nature and quantities of these "impurities". The refining and processing steps themselves are carefully conducted in another air-conditioned laboratory.

The use of automatic machines makes it possible to maintain a high standard of quality economically. The unit shown in Fig. 3 permits the coating of prepared baseplates with the selenium under closely controlled physical conditions. All the operator is required to do is to keep one end of the machine supplied with baseplates and selenium and to remove the partially completed cells at the other. Automatic controls observe any small deviations from normal and apply

Fig. 2. Chemical laboratory area for complete quality control of materials used in rectifier manufacturing

Fig. 3. Automatic machine for coating baseplates with selenium

the proper corrective measures to restore optimum conditions. Similar automatic machines supply the artificial barrier layer and front electrode. All of these operations are conducted in dust-free atmospheres, which are temperature and humidity controlled.

The completed cells are then subjected to "electroforming"—an electrical process by which the electrical characteristics are stabilized. One end of a line of specially designed electroforming cabinets is shown in Fig. 4. The automatic regulators between the cabinets supply the correct amount of electrical power at all times so that the maximum reverse voltage inherent in each cell is realized in the shortest possible time and contribute to the high efficiency of the rectifiers.

After cells have been "electroformed", their reverse and forward characteristics are checked, and the cells are then graded (a) according to the voltage at which the cell should operate for a low leakage current (reverse characteristic) and (b) according to their forward voltage drop at rated current (forward characteristic). This grading is done to assure uniformity in completed rectifiers. For example, when cells are connected in parallel for high current output, it is important that their forward characteristics be closely matched so that each cell carries its share of the total current. Likewise, when cells are connected in series for high-voltage operation, cells with the same reverse characteristics are used.

Fig. 4. "Electroforming" cabinets used to stabilize electrical characteristics of completed cells

Selenium Stack Assembly

Selenium rectifiers are assembled from individual cells connected in series, parallel, or both to achieve the voltage and current outputs required and in configurations to suit the circuit chosen. Cells are mounted on insulated studs separated by spacer washers, contact washers, and terminal lugs. The diameter of the stud used increases as the cell size becomes larger so that the completed rectifier exhibits good mechanical characteristics. For heavy-duty electroplating service, 5/16 inch (8 mm) diameter studs are commonly employed, inasmuch as the high current requirements for this service invariably call for the use of the larger size cells. Spacer washers serve two purposes: they separate the cells so that air currents can keep the cells at their proper operating temperature by carrying off the heat generated by the rectifying action, and they serve to contact the back electrode (negative) of each cell. Contact to the front electrode (positive) of each cell is made by means of a special diaphragm spring washer. The design of this washer allows it to seat tightly at its periphery against the front electrode surface so that finishing materials which will be applied later to the assembled rectifier can provide a tight seal.

Terminal lugs which extend beyond the cells allow circuit connections to be made within the rectifier and provide convenient terminals for external connection. In high-current electroplating rectifiers with many cells connected in parallel, inter-terminal connections are made with heavy brass, copper, or aluminum bus bar. Aluminum bus is generally preferred because of its lower weight. Well designed rectifiers also employ aluminum terminal lugs which are fastened to the bus with aluminum rivets. This construction provides higher mechanical strength than is possible with soldered brass or copper parts; furthermore, the all-aluminum junction is immune to internal contact troubles due to electrolytic-couple corrosion.

One of the many methods of assembly used is shown in Fig. 5. Here an air press and a positioning jig hold rectifier components in position while an operator tightens the assembly with a torque wrench. Hundreds of special jigs and fixtures are designed and kept readily available to provide speed and accuracy of assembly. Cell spacing, terminal positioning, and bus dimensions are held to close limits to facilitate later assembly of rectifiers into the complete equipment.

After a rectifier has been assembled, it is inspected and tested electrically. Its electrical characteristics and efficiency are checked under full load, and all current-carrying parts are tested for their insulation resistance to the mounting stud. When the rectifier

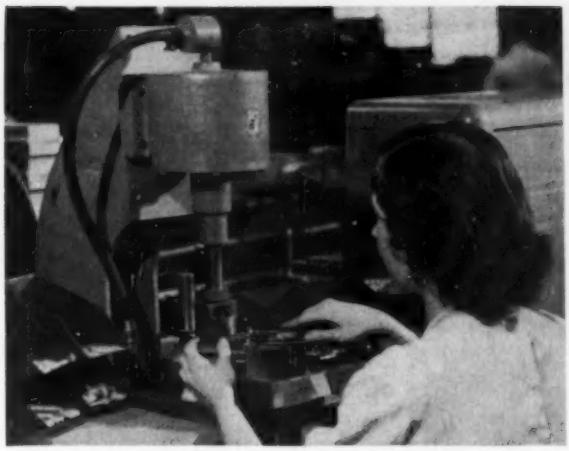

Fig. 5. Air press and positioning jig for the assembly of rectifier components

Fig. 6. Test equipment for checking rectifiers designed for high temperature service

meets the specifications, it is sent to the finishing department for a multiple-coat protective finish. Here the rectifier is first coated with a special inert primer providing a good foundation for succeeding coats of phenolic-resin varnish. As all other rectifier materials, these finishing materials are checked as they are received from the suppliers. Close control is also exercised over the purity and viscosity of the material as it is used.

These protective coatings are applied by dipping the rectifier in the finishing material (terminals and bus bar to which connections will be made are masked). The rectifier is not allowed to drip dry, but is spun to remove the excess coating and to assure an evenly distributed, tight film. Spinning time and speed are closely controlled. Each coat is thoroughly dried before succeeding coats are applied. In this manner, a dense, uniform, moisture-resistant finish is achieved. It has proved to be an excellent and reliable finish, especially in electroplating applications where conditions of high humidity and corrosive atmosphere prevail.

Following the finishing operation, each rectifier is again inspected and tested to make certain that it meets standards. To prevent abrasion of the protective finish, each rectifier is individually wrapped before it is packed and shipped.

Leadership in the field of selenium rectifiers is the result not only of high standards of workmanship but also of an extensive, long-range research program. Illustrative is the equipment shown in Fig. 6 in which experimental rectifiers designed for high-temperature operation are tested. With this apparatus, the complete electrical characteristics of test cells can be checked as they operate undisturbed in the oven at the left of the switching and metering racks. Other equipment is designed and used in the day-to-day control of production quality and in the investigation of new treatments and processes which hold promise of yielding still better rectifiers in the future.

Rectifier Units

Rectifier units are complete packages for converting the local a.c. supply into d.c. at the required voltage.

Although there may be some differences in detail, a rectifier unit for electroplating usually comprises the following basic elements:

1. Selenium rectifier stacks to convert low voltage a.c. to low voltage d.c.
2. Main transformer to step down the plant a.c. to low voltage a.c.
3. Voltage control (usually located between the plant a.c. and the primary of the main transformer) so that, finally, the d.c. voltage can be set to the optimum value for the process.
4. Meters—a d.c. voltmeter and a d.c. ammeter, both associated with the output from the rectifier to the tank.
5. Cooling system—frequently a fan, to circulate air between the cells of the rectifier stacks and prevent overheating.
6. Protective devices—various.

Any of the above elements can be dealt with at considerable length. For example, there are a variety of ways of achieving voltage control—including tapped auto-transformers with one, two or three controls, two, three or six switch sections; continuously variable (sliding brush) auto-transformers with two or three sections; induction regulators; and saturable reactors.

Furthermore, many more auxiliary devices and refinements can be added (especially if any type of automatic control is desired) but the above list represents the basic six.

Protective Devices

Most protective devices and circuits in an electro-

plating rectifier unit are designed to avoid damage to the selenium rectifier stacks since these are the most expensive components in the equipment and are, of course, indispensable. It is possible to continue operations in a plating tank even though one of the meters is burned out, it is even possible to continue with one or more faulty terminals in a voltage control switch, but if the selenium rectifier stacks burn out and d.c. is no longer available—that's all, you've had it!

Selenium rectifiers are subject to damage from four basic sources:

1. Overvoltage.
2. Corrosion.
3. Excessive temperature
4. Excessive current density.

In modern electroplating rectifier units breakdown from overvoltage is practically unknown. Selenium rectifier cells have a comparatively high inverse voltage rating and unless plates of inferior construction or defective one are used there is no reason to fear breakdown from this cause.

A phenomenon sometimes occurs in selenium rectifier units which have been standing idle for a considerable period of time—six months, a year, or several years. The inverse voltage rating may very slowly decrease and if the unit is started up with the controls set for maximum voltage an intermittent crackling or popping sound may be detected which usually decreases and finally stops as the cells quickly regain their normal inverse voltage characteristics. The slight possibility of permanent damage after long shutdown can be avoided quite easily. The unit is started with the voltage controls set to deliver *minimum* and then gradually the output voltage is increased, taking several minutes to reach maximum. In this way, no sudden stress is applied to the cells after a long idle period and the cells are given a chance to accommodate themselves to normal voltages.

No simple protective device can be installed to detect corrosion of rectifier plates in the manner of those devices that protect against excessive temperature rise. A variety of finishes, however, have been developed and the best of these, approved by the Navy, is entirely adequate for protection of equipment which has been properly installed. So far as is known, no finish available for selenium rectifier plates will withstand continuous attack by hot acid vapors and, in any case, other components in the equipment could not be expected to stand up to such treatment. An interesting attack on this problem is the use of indirect cooling (heat exchangers) which, in effect, encloses the rectifier unit within its own power supply room which can then be located on the floor of the plating room. Whether the additional cost and plating room space is justified must be decided by the potential user. The finish described earlier in this article, consisting of several individual coats, applied to the completed stack, results in corrosion resistance superior to that of many other parts in the rectifier unit.

Since excessive current density is connected with excessive temperature rise these two are usually treated as one. It is interesting to note, however, that selenium rectifier manufacturers now recognize that very high current density (amperes per square inch) can cause reduced life and early failure even if the cells are artificially kept at low temperature. Normally, electroplating rectifiers operate at well below such current densities.

A variety of protective devices and circuits have been developed and some of these may be briefly described.

One class of safety devices responds to abnormal temperature of the rectifier plates. The obvious arrangement is a thermostat near enough to the plates to be actuated by abnormal temperature rise. The thermostat may be used to give a visible warning, an audible warning or automatic shutdown. In any such arrangements absolute reliability of the thermostat is required since a period of several years may elapse before a set of conditions occurs which results in high temperature rise. A poor thermostat (for example one with exposed contacts which may become covered with dirt and hence fail to operate) is worse than none since the operator will rely on protection which he doesn't have. As in most machinery there is no substitute for quality.

It will be noted that the thermostat circuits, by responding directly to abnormal temperature rise, integrate a variety of factors—the temperature of the incoming air, the effectiveness of the cooling system, and the tank current delivered by the rectifier stacks.

Since about two-thirds or more of the internal watts dissipated by the rectifier stacks are accounted for by the current through the stacks, and since excessive current density is now recognized as a contributing factor to reduced life, some rectifier units are equipped with protective circuits which limit the maximum current which can be delivered. This usually takes the form of a relay connected across the ammeter shunt and so adjusted that it will shut down the rectifier unit if the tank current exceeds the normal rating of the rectifier unit.

Another form of current limitation prescribed by the Electrical Code is the insertion of primary fuses in the a.c. supply of a value not to exceed the rating recommended by the manufacturer of the rectifier unit.

In some earlier types of rectifier units it was important that operation should be discontinued immediately if the supply of air from the fan ceased. This was achieved by incorporating a switch operated by air flow so that any interruption of the air flow would immediately shut down the rectifier unit. Some modern rectifier units use auxiliary thermostats so that failure of the air flow, which naturally results in an increased temperature rise, will result in a warning or automatic shutdown.

A number of units are now equipped with protection against "single-phasing". (This is sometimes called

"anti-single-phase" protection.) This phenomenon may not be always understood although electrically it is actually quite simple.

All larger rectifier units are designed for operation from three-phase a.c. which means that the rectifier stacks are divided into three arms or into six arms with the work equally divided between the arms. If one of the three a.c. phases should disappear—for example due to the blowing out of a primary fuse in the plant or even due to a failure in the supply to the plant—then the work is not evenly divided between the several arms of the rectifier bank and the operator may drastically overload the remaining arms in an attempt to get full output. Rectifiers equipped with "anti-single-phase" protection simply shut down automatically if all three phases are not available at the input terminals of the rectifier unit.

Fig. 7. Testing temperature rise of rectifier stacks during operation

Factory Testing

An intangible, but important part, of the cost of better rectifier units is the rigorous testing to which they are subjected before release for shipment.

In the earlier part of this article the tests conducted on individual cells and on finished stacks by a manufacturer of high grade rectifier stacks has been described. These tests are, in at least one rectifier unit manufacturer's plant, supplemented by further testing. The incoming stacks are tested for reverse current leakage and forward resistance (forward voltage drop) before the stacks are accepted by the storeroom. After complete assembly of the rectifier unit the stacks receive, indirectly, a final test when the unit is operated at no load, full load, and over load. During these tests the temperature rise of the stacks is measured with thermocouples (see Fig. 7) inserted between the plates of the rectifier stacks. A considerable number of such thermocouples is used and a jackboard permits accurate temperature measurement of the incoming air, rectifier plates, transformers, etc.

In order to make such tests meaningful it is necessary to operate the completed rectifier unit at full load under conditions comparable to those which will exist in the electroplating plant. Fig. 8 illustrates typical test equipment used for this purpose so that the a.c. supply can be simulated and the full output of the rectifier unit can be absorbed in a resistive load.

Prior to final assembly of the rectifier unit practically all components are tested to see that they meet the specifications for components. Parts which are tested include, in addition to the rectifier stacks, transformers, meters, voltage controls, thermostats, fans, and even such minor items as lamps, buzzers, etc.

This 100 per cent testing of components and of complete rectifier units serves several purposes. The manufacturer is assured that the quality of all parts is being maintained and the customer is reasonably certain that the equipment will be capable of meeting its nameplate ratings from the day it is installed. By the time such a unit is shipped complete information has been obtained in the test department on temperature rise, overall conversion efficiency, power factor, and a variety of miscellaneous performance characteristics such as the operation of the protective devices, accuracy of the meters tested, etc.

Many factors in the design and construction of rectifier units for electroplating have been touched upon only briefly in this article. Most of these factors would be of interest only to engineers concerned with the design and building of such units. Perhaps those factors which have not been discussed in detail can be summarized by pointing out that a rectifier unit, like any other piece of assembled electrical machinery, is made up of a variety of parts. The overall quality of the unit depends not only upon the quality of the individual parts and the care with which these parts are put together but also to the extent that the final product is tested.

Fig. 8. Typical equipment for full load testing of completed rectifiers under simulated plating plant conditions

The following paper is one of several that was presented at the 1952 A. E. S. Melbourne Branch Conference. It is reprinted here through the courtesy of the Defense Research Laboratories, Maribyrnong, Victoria, Australia, which published all the papers presented at that Conference in their volume "Plating Notes".

Practical Experiences With Bright Zinc Plating

A. CHESTERFIELD*

Introduction

This paper is intended for the practical man engaged in plating bright zinc. Information is given on equipment, costs and the composition and control of plating and bright dipping solutions.

The Reason For Using Bright Zinc Plating

In one shop, cadmium and nickel were plated at one time, but because of the sharp increase in the cost of cadmium metal and the scarcity of nickel, management was forced to seek an alternative finish.

Products of this factory included a wide variety of kitchenware and wire trays for ice-chests and refrigerators. A bright corrosion-resistant finish that is not toxic, and that can be used in contact with foodstuffs was required. Bright zinc was selected because of good appearance and low cost. Zinc anodes cost only 21 to 22 cents per pound compared with $2.15 per pound for cadmium anodes.

Plating efficiency of zinc is about 30 per cent less than that of cadmium, but the higher current density that can be used with zinc permits the maintenance of the same production rate. Additional current capacity is required, and slightly more power is used, but the total cost of plating zinc is much less than that of cadmium. The bright zinc bath is easy to operate.

Equipment

The equipment needed for bright zinc plating is the same as for cadmium plating, and it is as follows: steel tanks for alkaline cleaning solutions and zinc plating bath, lead-lined tank for acid pickling solution, earthenware crocks or small lead-lined tanks for bright-dipping solutions. Current may be supplied from either a rectifier or generator.

Cleaning

The ordinary methods for cleaning the work before plating are used. The work is first cleaned electrolytically in an alkaline solution, then pickled in a hot 5 per cent solution of sulfuric acid followed by further electrolytic cleaning in a cold alkaline solution. The work is thoroughly rinsed, of course, after each stage.

Bright Zinc Plating Solution

The writer has tried several different solutions, and the following composition is the best of these and the easiest to control.

Zinc Cyanide	10	ozs
Sodium Cyanide	6	ozs
Sodium Hydroxide	12	ozs
Sodium Sulfide	0.1	oz
Sodium Thiosulfate	0.1	oz
Water	1	gal

The solution should be prepared in a clean tank, preferably one that has not been used with another solution. The tank should first be filled to about two-thirds of its capacity with water at a temperature of about 120° F. The sodium hydroxide, sodium cyanide and zinc cyanide are then added and dissolved in that order.

The bath is then purified by adding the sodium sulfide, and then the sodium thiosulfate. The bath is then allowed to stand for several hours before adding the brighteners. The author has tried many different brighteners including nickel, glue, molybdic acid, and

(Continued on page 263)

* Member, A. E. S., Melbourne Branch and Foreman Electroplater, Premier Wire Works.

POLAROGRAPHIC DETERMINATION OF LEAD IN LEAD PLATING SOLUTIONS

RAFAEL DIAZ*

A RAPID CONTROL method employing the use of the polarograph is described for the analysis of lead in lead plating solutions. The diffusion current of the lead ion in a medium containing potassium nitrate as indifferent electrolyte is very well defined and forms the basis for this determination. The time required for an analysis is just a fraction of that required when lead is analyzed by the common acid-sulfate gravimetric procedure because no weighing of the sample, precipitation or drying to constant weight are needed in the procedure.

According to Kolthoff and Lingane[1], the reduction of lead ion is reversible at the dropping mercury electrode and the diffusion current is very well defined in the presence of a small amount of gelatin. In 1N potassium nitrate the half-wave potential is found to be -0.703 volt when a stationary pool of mercury is used as the anode. This potential is quite reproducible under the experimental conditions. The concentration of gelatin, while not critical, should be kept below 0.01 per cent and the amount added provides for a final concentration of gelatin of about 0.004 per cent. This may be substituted by an even smaller concentration of the sodium salt of methyl red (about 2×10^{-4} per cent). Methyl red is itself reduced at the dropping electrode, but the concentration used is so small that it will have no appreciable effect on the diffusion current of the lead ion.

The author knows of no interferences in the procedure with the exception of tin, whose chlorostannic complex gives a wave at -0.48 volt (vs. a stationary mercury pool). This interference would only be serious if tin were present with enough chloride to form a chlorostannic complex and in such high concentration that its wave would obscure that of the lead, which appears at a more negative potential. If such were the case, a method of separation would have to be used. Kolthoff and Lingane[1] make use of sodium hydroxide for the simultaneous analysis of tin and lead and ob-

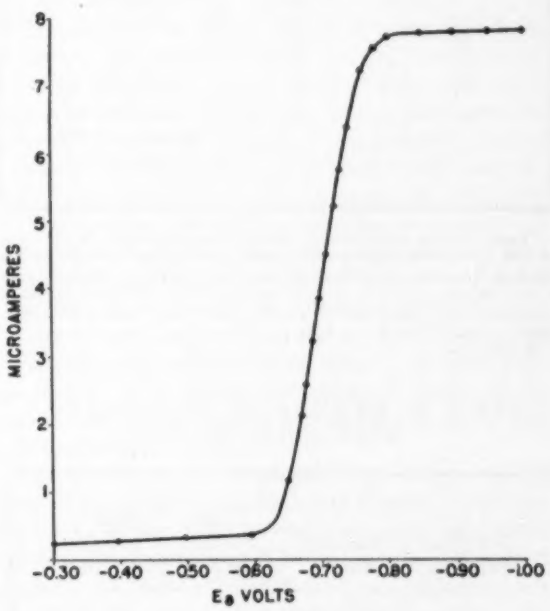

Fig. 1. Polarogram of lead in lead plating solution

*Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

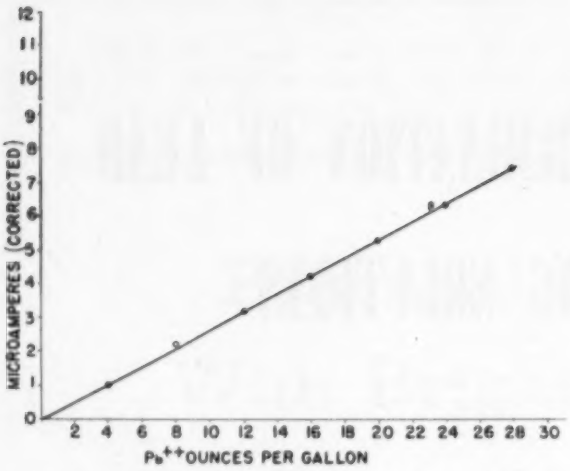

Fig. 2. Calibration curve for lead in lead plating solutions. Data from Table I

TABLE I. DATA FROM POLAROGRAMS OF LEAD PLATING SOLUTIONS OF VARIOUS CONCENTRATIONS*

Conc. of Lead oz/gal	Diffusion Current in microamperes†	Diffusion Current Microamps. per oz/gal†
0	....	....
4	1.09	0.273
8	2.15	0.269
12	3.25	0.271
16	4.32	0.270
20	5.39	0.270
24	6.47	0.270
28	7.57	0.270
		Average 0.270 ±0.007

*Lead plating solutions of various concentrations of lead ion in 2M potassium nitrate and gelatin as directed by the procedure in the text. Air removed from the solutions with nitrogen. t = 3.80 sec., $m^{2/3}t^{1/6}$ = 2.30 $mg^{2/3}sec^{-1/2}$. Diffusion currents measured at a potential of −0.703 volt with respect to a stationary mercury pool.

†Corrected.

TABLE II. RESULTS OF ANALYSES OF LEAD SOLUTIONS*

Solution Number	Amount Added	Volumetric Method	Polarographic Method
1	27.2	27.1	27.1
2	25.7	25.6	25.4
3	20.8	20.7	20.9
4	25.0	24.8	24.9
5	23.5	23.5	23.3

*Concentration of lead expressed in oz/gal.

tain two widely separated waves, thus eliminating any possibility of obtaining the two waves at approximately the same potential. This method seems very suitable for application in the case of the tin-lead alloys.

Since tin is not encountered in lead plating solutions except possibly as an impurity it would not interfere with the lead determination because its concentration would be so small that no danger of obtaining a coalescing wave with tin would be present.

A typical polarogram of lead in a plating solution is shown in Fig. 1.

Reagents and Apparatus

2M Potassium nitrate solution
Gelatin 1 per cent solution
Mercury, triple distilled, for the mercury pool and the dropping electrode
Sargent manual polarograph, Model 3

Procedure

Calibration

A calibration chart was constructed by measuring the diffusion current of several lead plating solutions prepared in the laboratory from analytical reagents. This calibration chart is, of course, valid only for the particular instrument and electrode with which it was prepared; if for any reason it becomes necessary to replace the capillary, then the curve must be redetermined. Even if no such replacement is necessary, it is advisable to make regular determinations on standard solutions to determine whether the characteristics of the instrument have varied with time. This is especially important as regards the sensitivity of the galvanometer. The data obtained from these polarograms, and the diffusion current constants calculated therefrom, are shown in Table I. The data from Table I are shown plotted in graph form in Fig. 2.

Lead Plating Solution

Pipette 1.0 ml of sample into a 500 ml volumetric flask. Add 4 ml of a 1 per cent solution of gelatin and dilute with water to the mark. Pipette 5.0 ml of this solution into the polarographic cell and add 5.0 ml of 2M potassium nitrate. Record the polarogram between −0.50 and −1.00 volts, applying a bridge potential of 1.0 volt.

Results and Discussion

Table II shows the agreement obtained between the polarographic and gravimetric methods for the analysis of lead in some plating solutions. The figures show that the method gives results in agreement with the gravimetric values to within less than 2 per cent in the range of concentrations studied. Such accuracy is perfectly adequate for the purpose of routine control of the lead plating baths.

LITERATURE CITED

[1]Kolthoff and Lingane, "Polarography", Interscience Publishers, Inc.

Bright Zinc Plating

(*Continued from page 260*)

thiourea, but coumarin (0.5 oz/gal) has given best results, and it is easy to control.

Control of the Solution

Low concentration of sodium hydroxide in the solution makes the plating of bright deposits difficult, and the need for additions of caustic soda is shown by a rise in voltage and a fall in amperage shortly after the work is placed in the bath.

Low concentration of cyanide in the bath is shown by a white incrustation on the anodes. Low zinc concentration is rare, and it is shown by a very light zinc deposit on the work. Zinc plated out of the bath is normally replaced by solution from the anode, but if the bath becomes depleted in zinc it can be brought back to the required strength by allowing the anodes to remain in the bath while it is not in use.

Zinc concentration in the bath sometimes becomes too high with ordinary use, and burning may occur on those parts of the work where current density is high. High zinc concentration can be reduced by using one or two steel anodes in place of zinc anodes.

Anodes

Electrolytic zinc ingots, as used for hot-dip galvanizing, are used for anodes, and they are entirely satisfactory. Anode area is important, and it should not exceed 75 per cent of the cathode area.

The anodes should be taken out of the bath when it is not in use as they dissolve fairly rapidly owing to the potential difference between the zinc and the steel tank, and this will result in an excessive amount of zinc in the bath.

Bright Dipping

For bright dipping, best results have been obtained by dipping, first, in a chromic acid solution, and then in either a peroxide-sulfuric acid or a peroxide-nitric acid solution. The chromic acid solution contains 8 oz/gal chromic acid and a little sulfuric acid. The bleaching solution, which also improves the brightness of the zinc, contains 4 oz/gal hydrogen peroxide, and 2.5 oz/gal of either sulfuric or nitric acid. (The protective value of chromate films when treated this way appears to be doubtful. Ed.) Immersion for about 10 seconds in each solution is usually sufficient. Dipping is followed by two rinses and drying in sawdust, the second rinse is in hot water.

When a bright finish is not obtained after dipping, the bright dipping solution should be checked and, if necessary, it should be strengthened or renewed. If the bright dipping solution is satisfactory brightener should be added to the plating solution and, if this has no effect, then hydroxide and, last of all, cyanide concentration should be checked. No chemicals are added to the plating solution in order to overcome troubles without first checking the points mentioned.

Book Review

DR. HAROLD J. READ

Professor of Metallurgy, Pennsylvania State College

Chemicals of Commerce by Foster Dee Snell and Cornelia T. Snell, 2nd edition, 1952, ix + 587 pages. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3, N. Y. Price, $6.50.

Although this book contains a wealth of information useful to almost any chemist, it was written particularly for manufacturers and others whose technical background encompasses only an elementary knowledge of inorganic and organic chemistry. So far as imparting information at the specified level of technicality is concerned, the authors have succeeded admirably, but one is led to doubt seriously whether readers with limited experience in chemistry will always be able to find the specific information which they are seeking.

Contrary to the usual practice of arranging the entries alphabetically in compendiums of this sort, the authors have divided their material into some 38 chapters, each devoted to a group of similar products, such as inorganic acids, calcium compounds or phenols and their derivatives. Although this scheme has the advantage of presenting in one place similar substances having diverse names, there appear to be some serious disadvantages. It presupposes too much knowledge on the part of the prospective reader. A user with the limited chemical background referred to above who wants information on anethol could hardly be expected to know that it is an ether. Without this bit of knowledge, location of the entry is an almost hopeless task. If he could do no more than guess that anethol is an organic compound, as might well be the case, he would have 20 chapters in which to search. This is a bit discouraging, particularly since the arrangement of entries in the individual chapters is topical rather than alphabetical. Even the experienced chemist may have some trouble, e. g., he might thumb fruitlessly through the chapter on extracts of natural products looking for cinchonine while congratulating himself on remembering that it is extracted from cinchona bark. If he doesn't discover the chapter on alkaloids, he never will find the desired information.

The number of typographical errors is inexcusable, particularly in the second edition of a book. There are also errors of fact, some of which are quite ridiculous, e. g., the statement on p. 117 that cryolite in the Hall cell for production of aluminum ". . . is kept fused by passing an arc between carbon electrodes . . .". Electroplaters will be puzzled by a passage on p. 126 which gives the impression that bright-nickel plating is a competitor for chromium plating.

So far as the metal finisher is concerned there are other chemical encyclopedias which should be far more useful.

40th Annual A. E. S. Convention

The Educational Program

Restaurant Information

Technical Papers

The program for the 40th annual Technical Session will truly deserve description as being outstanding.

The all-important matter of chromium plating will be the subject of a symposium conducted under the able chairmanship of Dr. Richard M. Wick of Bethlehem Steel and a member of the Allentown-Reading Branch.

The old problem of producing a truly crack-free chromium plate appears to be pretty well licked. The process for accomplishing this will be outlined in a paper authored by R. Dow and J. E. Stareck of United Chromium, Inc.

A paper on "Black Chromium-Base Electroplating" will be presented by Dr. Martin F. Quaely of the Westinghouse Electric Corporation's Lamp Division Research Department. This will tell how to obtain black finishes which have good adherence to base metal.

Do you hesitate to submit a bid on a chromium job because you are afraid of your own estimate? A fool-proof method of preparing such cost figures will be presented by P. Lonsbury in a paper called "Costing in Job Chromium Plating" and co-authored by Walton and Lonsbury.

The matter of chromium recovery through ion exchange is of growing interest. C. F. Paulson of Permutit will discuss this process which uses a new cation exchanger effective in the treatment of solutions containing up to 40 per cent chromic acid.

Two papers to be presented at the technical sessions on plating solutions deal with the related problems of cyanide decomposition and carbonate removal. In one of these the evaluation and effect of carbonate removal methods will be discussed by R. Scott Modjeska of Scientific Control Laboratories.

The other paper, submitted by Drs. Meyer, Serfass and Muraca, is concerned with factors which result in loss of cyanide and the methods for minimizing that loss.

Those who have followed Walter Pinner's work on the effect of abrasive metal polishing will want to hear of his further findings concerning the influence of polishing on the quality of the final plate.

Due to the poor oxidation resistance of molybdenum at elevated temperatures, there is a strong need for a relatively thin protective plated coating. Al Korbelak, Editor of PLATING, will tell how to accomplish this using a new technique.

And this is just half the program—more next issue.

Eating Places

Of particular importance to the ladies is the question of where to eat. The Headquarters Hotel, the Benjamin Franklin, is equipped with an excellent dining room and a coffee shop but some will want to investigate the various eating places around town.

Probably the most famous eating house, a short taxi ride from the hotel, is Bookbinders Old Original Restaurant at 125 Walnut Street. Here are served some of the finest (and most expensive) sea food and steaks to be found. There are two dining rooms, one with a saw-dust floor and marble-top table atmosphere and the other with a rustic hunting room atmosphere.

For continental eating with a Russian atmosphere there is The Inn at 1233 Locust Street, which features moderate prices and classical music at dinner time.

If good music is the order of the day, visit the Victor Cafe at 1303 Dickinson or Maurice's at 211 S. Quince Street.

Chinese food, inexpensive but good, is served at the Cathay Tea Garden, a large uncrowded place with appropriate atmosphere.

Good sea food at moderate prices can be found at Kelley's, 16 N. 12th Street, across from the Reading Terminal. Even better sea food is to be had at Kelly's at 5 S. Mole Street, and at Tilles, 1528 Chestnut, but these last two are a long walk from the hotel.

These suggestions represent only a small cross section of Philadelphia's list of restaurants but should serve as a good guide. A word of warning—some may be closed Mondays, so check in advance to avoid being disappointed.

Hotel Reservations

By way of a reminder, printed below is a facsimile of the room reservations card recently circulated to all members. Reservations may be sent directly to The Benjamin Franklin, Chestnut Street at Ninth, Philadelphia 5, Pa. When filling out the reservation form please recheck with the letter circulated by Thomas Rodgers and if you require a single room send your reservation directly to him at 106 Woodside Avenue, Narberth, Pa.

Please cooperate with the Reservation Committee by returning your reservation card promptly.

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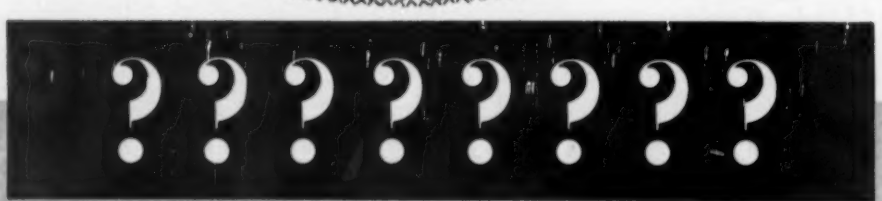
PRICE

"There is hardly anything
in the world that some man
cannot make a little worse
and sell a little cheaper,
and the people
who consider price only
are this man's lawful prey."

Ruskin

INDICATE A 358.



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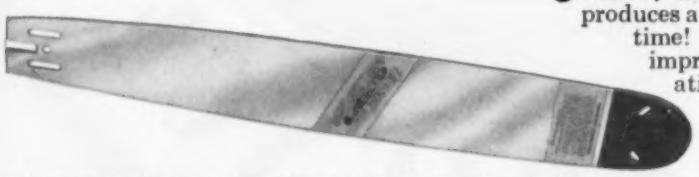

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†SERVED AS PROJECT DIRECTOR WHILE DR. B. F. DODGE WAS ON LEAVE OF ABSENCE

DISPOSAL OF PLATING ROOM WASTES

V. TREATMENT OF CYANIDE WASTE SOLUTIONS BY ION EXCHANGE

(*Continued from the February, 1953 issue*)

Discussion of Results

This section will present and discuss the results obtained.

The first phase of the investigation was concerned mainly with the selection of satisfactory resins (on the basis of experimental investigations) among those which had been chosen as a result of a survey of the published literature on the general field of ion exchange.

The second phase of the investigation was concerned with the selection of ion exchange systems which could be applied to the treatment of each of the solutions used.

In all of the investigations the ion exchange treatment was carried out continuously with the solution flowing downward through the bed.

A dilute synthetic zinc plating solution was chosen for the preliminary investigations.

A. *Selection of Ion Exchange Resins*

The following information was obtained as a result of the preliminary investigations (Tables II and III).

Whenever referring to the results of an experimental run, the reader is advised to use Tables I–III together. Table I lists the ion exchange resins, Table II lists the physical variables, resins and regenerants used in each run, Table III gives the actual ion exchange data for each run, i. e., the results obtained in both exhaustion and regeneration cycles.

(a) A strongly basic anionic resin removed the cyanide and zincate ion completely until the break-through point had been obtained (Run 2), while a weakly basic anionic resin allowed the anions to leak through from the beginning of the treatment (Run 3).

(b) Of the strongly basic resins, E* and G were more easily regenerated than D and F† respectively (Runs 7, 8, 9).

The weakly basic anionic resins, as expected, did not remove the anions satisfactorily, because the *p*H of the solutions was far above the maximum limit for effective operation with these resins.

The superior regenerating qualities of resins E and G as compared with D and F may be ascribed to the somewhat lower alkalinity of the former resins and their higher affinity for the hydroxyl ion.

B. *Selection of an Ion Exchange System*

A dilute zinc plating solution was also used in the investigations which were concerned with the selection of a satisfactory ion exchange system on the basis of good removal and recovery of the cyanide ions as well as the metallic ions.

A single anionic resin system was to be compared with a dual cationic-anionic resin system. The latter system may consist of a hydrogen type of a cationic resin in series with a hydroxyl type of a strongly basic anionic resin. If a cyanide solution is passed through the cationic resin, the hydrogen ion from the resin will replace

*These are designations for commercial resins. (See Table I)
†The results of the investigations with F are not shown here.

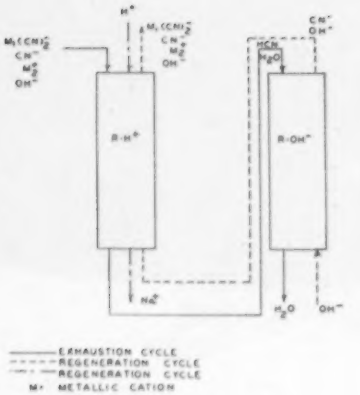

Fig. 4. Dual Bed Ion Exchange Scheme

the alkali-metal cation in the solution causing a lowering of the *p*H to a low acidic range. At this *p*H some complex cyanides will at first decompose into metallic cyanide and hydrogen cyanide, and secondly, the metallic cyanide will be decomposed into the corresponding metallic ion and hydrogen cyanide. Complex cyanides which decompose readily and to completion are those containing zinc, silver and cadmium. The metallic ion, being a cation, is exchanged on the cation resin and the effluent obtained becomes a demineralized aqueous solution of hydrogen cyanide. The hydrogen cyanide is then exchanged on the anion resin.

The dual bed ion exchange scheme (Fig. 4) is particularly successful with solutions containing the hydroxyl ion as one of the anions, since this ion is neutralized by the hydrogen ion with subsequent formation of the water molecule. If the carbonate ion is present instead of the hydroxyl ion, carbonic acid will form as a result of the cationic exchange with the hydrogen ion, and this acid will have to be removed by treatment with a strongly basic anion exchange resin unless the effluent from the cation resin is degassed to remove CO_2. Thus in the former case the anion resin will be used exclusively for the removal of hydrogen cyanide while in the latter case part of its capacity will be used in removing carbon dioxide.

The effluent obtained from the treatment of a cyanide waste solution in a dual resin system contains no minerals and has an approximately neutral *p*H. This means that it can be reused in electroplating operations thus decreasing the over-all water consumption and making available a water whose purity is greater than that of ordinary tap water.

In these particular investigations it was found that more concentrated solutions were obtained in the regeneration of a dual system of resins than of a single anion exchange resin (Runs 2 and 6). Moreover, the superior regenerative qualities of both resins E and G as compared with resins D and F were again shown (Runs 7, 8 and 10).

In the exhaustion runs it was again found that the weakly basic anion exchange resins allowed a considerable leakage of cyanide although not as great as in the single resin ion exchange system as shown by Run 4. In this run the *p*H of the effluent from the cation exchange treatment was about 3 so that most of the cyanide was present as HCN. When the cyanide solution had been treated by an anion exchange resin only (Run 3), the cyanide was present in some ionic form and cyanide was actually exchanged. In Run 4 it is believed that HCN was adsorbed rather than exchanged. Any exchange would involve splitting of the highly unionized HCN, which is hardly expected to occur when a weakly basic anion exchange resin is used.

In spite of the poor results obtained with the weakly basic anion exchange resins, it was decided to try out one more scheme since these resins are known to have a high affinity for complex ions and are believed to be easily regenerated by the hydroxyl ion. This scheme involved treating the metallic-cyanide solution with a cation exchange resin in such a way as to obtain a *p*H between 6 and 7. At this *p*H the solution would contain the metallocyanide complex and hydrogen cyanide. It would be passed through a weakly basic cation exchange resin where the complex would be exchanged and then through a strongly basic anion exchange resin where the hydrogen cyanide would be exchanged. Experimental investigations of this scheme did not give results according to expectations and the weakly basic ion exchange resin did not show any more affinity for the complex cyanide ion than for the free cyanide ion or the HCN molecule.

The dual system of resins, using a strongly acid cation exchange resin in series with a strongly basic anion exchange resin, was therefore selected as giving the best results, and was tried with dilute silver and copper plating solutions.

It was also decided to compare these results with those obtained when using an anion exchange resin only.

The results obtained with each solution will be discussed separately.

TABLE I. RESINS USED

Designation	Type	Commercial Identification
A	Cation, strong acid	Amberlite IR-120
B	Cation, weak acid	Amberlite IRC-50
C	Anion, weak base	Amberlite IR-45
D	Anion, strong base	Amberlite IRA-400
E	Anion, strong base	Amberlite IRA-410
F	Anion, strong base	Dowex 1
G	Anion, strong base	Dowex 2

C. *Experimental*

1. Zinc plating solution

As previously discussed, the most satisfactory treatment of this solution was obtained by passing it through a strongly acidic cation exchanger containing exchangeable hydrogen ions and through a strongly basic anion exchanger containing hydroxyl ions. A sodium hydroxide (10 per cent) regenerant solution was passed in series through the cation and the anion exchanger or vice versa. The cationic resin had to be regenerated a second time to replace the sodium ions with hydrogen ions.

2. Copper plating solution

It was decided at first not to use the dual resin scheme in treating solutions containing copper (ous) cyanide complex ion since as a result of previous investigations[2] it had been found that metallic cuprous cyanide resulting from the decompoeition of copper cyanide complex ion was very stable even in the presence of most mineral acids. It was expected that copper cyanide would be present in the effluent from the cation exchange treatment and having no electrical charge would leak through the anion exchange resin.

It was decided, therefore, that solutions containing cupro-cyanide complex ions would be treated with an anion exchange resin only.

Several unexpected results were obtained in the investigations following such a decision and they will be listed below in a chronological sequence:

(a) The free and complex cyanide ions were removed completely from the treated solution by a carbonate type of resin but were difficult to recover by regeneration with a 2.77 N sodium carbonate solution, the free cyanide ion only being recovered and in very low concentrations (Run 11).

(b) A sodium cyanide-sodium carbonate solution with a CO_3/total CN ratio equal to that of the copper plating solution was treated. Good removal was obtained but the regeneration with

TABLE II. EXPERIMENTAL CONDITIONS

Run No.	Type of Solution	Feed: Total CN ppm	Feed: pH	Exhaustion Cycle: Cation Resin	Exhaustion Cycle: Anion Resin	Exhaustion Cycle: Flow Rate* cu ft/cu ft min	Exhaustion Cycle: Flow Rate ft/min	Regeneration Cycle: Regenerant†	Regeneration Cycle: Flow Rate cu ft/cu ft min	Regeneration Cycle: Flow Rate ft/min	Regeneration Cycle: Remarks on Regeneration
2	Zn Plating	104	11.1	—	E, OH^-	0.30	0.06	NaOH	0.20	0.38	Poor
3	Zn Plating	104	11.1	—	C, OH^-	0.30	0.06	—	—	—	■
4	Zn Plating	104	11.1	A, H^+	C, OH^-	0.32; 0.38	0.06	—	—	—	■
5	Zn Plating	104	11.1	A, H^+	E, OH^-	0.45; 0.33	0.16	NaOH	0.14; 0.10	0.05	Good
6	Zn Plating	104	11.1	A, H^+	E, OH^-	0.21; 0.37	0.07	NaOH	0.13; 0.24	0.026	Good
7	Zn Plating	200	11.3	A, H^+	E, OH^-	0.35	0.13	NaOH	0.14	0.05	Good
8	Zn Plating	200	11.3	A, H^+	D, OH^-	0.35	0.12	NaOH	0.15	0.054	Poor
9	Zn Plating	200	11.3	A, H^+	G, OH^-	0.36	0.13	NaOH	0.14	0.05	Good
10	Zn Plating	20	10.1	A, H^+	G, OH^-	0.45	0.16	NaOH	0.15	0.055	Good
11	Cu Plating	200	10.5	—	G, CO_3^{--}	0.35	0.12	Na_2CO_3	0.14	0.05	Very poor; No Cu
12	$NaCN^-$‡ Na_2CO_3	200	—	—	G, CO_3^{--}	0.35	0.12	Na_2CO_3	0.14	0.05	Poor; No Cu
13	$NaCN^-$‡ Na_2CO_3	200	—	—	G, CO_3^{--}	0.35	0.12	K_2CO_3§	0.14	0.05	Poor; No Cu
14	Cu Plating	200	10.5	—	G, CO_3^{--}	0.36	0.13	NaOH	0.14	0.05	Poor; No Cu
15	Cu Plating	200	10.5	—	G, OH^-	0.36	0.13	NaCN◆	0.14	0.05	Fair; Cu
								NaOH			Very Good
16	Cu Plating	200	10.5	—	G, OH^-	0.36	0.13	NaCN	0.14	0.05	Fair, Cu
								NaOH			Very Good
17	Ag Plating	1000	10.9	—	G, OH^-	0.35	0.12	KCN	0.14	0.05	No regeneration
								NH_4OH			Poor, No Ag
18	Ag Plating	1000	10.9	A, H^+	—	0.35	0.12	NH_4OH	0.14	0.05	Good
								HCl			*
19	Ag Plating	1000	10.9	A, H^+	—	0.48	0.16	KNO_3▲	0.14	0.05	*
								NH_4OH			Good
20	Ag Plating	1000	10.9	A, H^+	—	0.48	0.16	NH_4OH	0.14	0.05	Fair
21	$AgNO_3$	735	—	A, H^+	—	0.48	0.16	NH_4OH	0.14	0.05	*
								NaOH–NaCN●			Very Good
22	Ag Plating	1000	10.9	A, H^+	—	0.60	0.20	NaOH	0.16	0.06	Poor
								NaCN			Excellent
23	Ag Plating	1000	10.9	A, H^+	—	0.55	0.18	$Ca(NO_3)$▲	0.14	0.05	*
								NaCN²			Excellent
29	Cu Plating	1000	10.9	B, H^+	C, OH^-	0.35	0.12	NaOH	0.14	0.05	Fair
30	Cu Plating	1000	10.9	—	C, OH^-	0.35	0.12	—	—	—	■
31	Cu Plating	1000	10.9	A, H^+	—	0.35	0.12	NaCN	0.14	0.05	Good
33	Cu Plating	1000	10.9	A, H^+	—	0.35	0.12	HCl	0.14	0.05	Fair
34	Cu Plating	1000	10.9	A, H^+	G, OH^-	0.35	0.12	NaCN	0.14	0.05	Very Good
35	Cu Plating	1000	10.9	—	G, OH^-	0.35	0.12	NaCN	0.14	0.05	Fair

*Diameter of column in Runs 2–6 = 0.426 in; in Runs 7–23 = 1.06 in
†Solutions are 2.8 N unless otherwise specified
‡Na_2CO_3/NaCN ratio same as in copper plating solution
§9.3N K_2CO_3
◆1.46 N NaCN
▲1.4 N
●Batch regeneration
■Not attempted because exhaustion run was poor
*No regeneration obtained.

TABLE III. EXHAUSTION AND REGENERATION EXPERIMENTS

A. Zinc Cyanide Solutions

Run No.	Anion Exchange Effluent			Regeneration Effluent					
	Cu ft/cu ft of Resin	Total CN, ppm	Lb of CN/cu ft of Resin before break-through	Cu ft/cu ft of Resin	Total CN, ppm	Cumulative Total CN, ppm	Total CN Regenerated lb/cu ft of Resin	Total CN Regenerated Per cent	Lb of CN Regenerated/100 lb of Regenerant
2	0–92.5	< 0.5*	0.601	0–9.2	1070	—	1.71	—	—
	92.5–111	1.8		9.2–18.4	754	912		51.5	0.81
	111–130	4.5		18.4–23.2	580	846		59.8	0.76
	130–204	7.7		23.2–34.2	428	714		74.0	0.65
	204–278	19.6		34.2–38.8	344	695		78.9	0.61
	278–370	36.5		38.8–43.5	230	622		82.2	0.57
3	0–5.3	4.15	< 0.04				NOT ATTEMPTED		
	5.3–10.6	—							
	10.6–21.7	72.7							
	21.7–37.7	82.0							
4	0–5.3	4.15	< 0.04				NOT ATTEMPTED		
	5.3–10.6	2.0							
	10.6–15.9	8.3							
	15.9–21.2	—							
	21.2–34.0	86.0							
5	0–10.4	< 0.2	0.721	0–0.71	1250	1250	0.89	5.7	1.13
	10.4–12.6	0.78		0.71–1.43	4800	3025		27.5	2.74
	12.6–14.0	5.6		1.43–3.14	4590	3870		77.5	3.50
	14.0–14.7	15.6		3.14–3.78	3460	3460		83.5	3.12
	14.7–15.4	—		3.78–4.65	2970	2970		87.5	2.67
				4.65–6.06	2360	2360		91.0	2.12
6	0–83.3	< 0.1	0.601	0–1.85	1300	1300	0.83	17.9	1.15
	83.3–102	0.5		1.85–3.7	4760	3030		83.2	2.73
	102–120.5	18.2		3.7–5.55	1190	2383		98.4	2.15
	120.5–139	46.8							
	139–157.5	81.0							
7	0–47.5	0.03	0.791	0–0.35	71	—	0.894	—	—
	47.5–63.5	0.26		0.35–0.67	5850	5850		11.5	5.3
	63.5–79.3	13.5		0.67–1.38	9500	8400		53.6	7.56
	79.3–83.4	79.0		1.38–1.71	6070	7830		66.0	7.1
				1.71–2.27	2110	6180		73.8	5.6
				2.27–2.59	1900	5630		76.8	5.0
				2.59–2.94	1335	4975		79.2	4.47
				2.94–3.25	1040	4550		82.2	4.13
				3.25–4.84	780	3225		89.4	2.91
8	0–47.5	0.03	0.75	0–0.635	110	—	0.224	—	—
	47.5–63.5	0.89		0.635–1.72	1505	1505		12.8	1.37
	63.5–64.3	4.5		1.72–2.71	1090	1280		20.9	1.17
				2.71–3.37	874	1180		25.3	1.07
				3.37–4.01	651	1080		28.5	0.97

*Less than 2 ppm Zn

TABLE III. Continued

Run No.	Anion Exchange Effluent			Regeneration Effluent					
	Cu ft/ cu ft of Resin	Total CN, ppm	Lb of CN/ cu ft of Resin before break-through	Cu ft/ cu ft of Resin	Total CN, ppm	Cumulative Total CN, ppm	Total CN Regenerated lb/cu ft of Resin	Total CN Regenerated Per cent	Lb of CN Regenerated/ 100 lb of Regenerant
9	0–79.3	0.03	1.09	0–0.318	155	—	0.987	—	—
	79.3–95.2	0.73		0.318–1.58	8590	8590		56.0	7.65
				1.58–2.85	2580	5582		73.0	5.0
				2.85–3.5	1535	4773		78.0	4.26
				3.5–4.12	1050	4150		81.5	3.7
10	0–767.5	0.03	1.05	0–0.318	1045	1045	0.967	1.9	—
	767.5–831	0.41		0.318–1.9	7390	6330		70.0	5.72
	831–847	0.78		1.9–2.86	1710	4790		79.0	4.32
	847–851	—		2.86–4.43	1200	3500		90.0	3.15
					Zn	Zn	Zn	Zn	Zn
				0–0.318	—	—	0.68	—	—
				0.318–1.9	1115	1115		16.1	1.14
				1.9–2.86	3380	1960		44.0	1.78
				2.86–4.43	2550	2190		79.5	1.93
				4.43–5.23	750	2080		96.0	1.66

2.77 N Na_2CO_3 was again poor (Run 12). This indicated that regeneration of the cyanide ion by the carbonate ion was much less efficient than for the case of the hydroxyl ion regenerant.

(c) Even an increase in the concentration of the carbonate regenerant (9.3 N K_2CO_3) did not improve the regeneration appreciably (Run 13).

(d) Better results were obtained in the regeneration of the resin with hydroxyl ion as shown in Run 14 and the capacity of the hydroxyl type of resin seemed to be greater than the carbonate type. However even the hydroxyl ion did not remove the copper cyanide complex.

(e) Regeneration of the resin with the cyanide ion removed the copper cyanide complex in appreciable concentrations, although not comparable to the concentrations of the regenerated free cyanide (see Runs 15 and 16). The ability of the cyanide ion to remove the complex cupro-cyanide ion could be explained on the basis that a higher cyanide complex is formed in more concentrated solutions. It is a known fact[13] that the following two types of copper cyanide complexes exist in dilute solutions: $Cu(CN)^-_2$ and $Cu(CN)^{-}_3$. The ratio of the concentration of $Cu(CN)^{-}_3$ to $Cu(CN)^-_2$ increases as the total concentration of CN^- increases[14]. In very concentrated solutions, such as those used for plating, it is believed that the shift is towards the tetracyano complex[13], i. e. $Cu(CN)_4^{---}$.

In Run 35 it is shown how it is possible to regenerate almost to completion the copper cyanide complex from a strongly basic anionic resin by using a cyanide solution. However, the concentration of copper in the regenerated solution even for 57 per cent recovery is relatively low. Similar results had been obtained in Runs 15 and 16.

The dual ion exchange system was tried out with dilute copper plating solutions. At first, the copper cyanide solution was passed through a strongly acid cation exchange resin (see Runs 31 and 32). Although some copper leaked through the resin, the amount was relatively small and most of the copper was later exchanged by a strongly basic anion exchange resin (see Run 34). A white band similar to that obtained later in the cation exchange treatment of silver cyanide solutions was observed. This band traveled down the bed and when it reached the bottom of the bed, relatively large amounts of copper began to leak through indicating that a break-through point had been reached. It is believed that the white band consisted of cuprous cyanide.

The cation exchange resin was regenerated either with HCl solution (see Run 33) or with NaCN solution (see Runs 31 and 34). The latter regenerant was superior to the former since it regenerated copper in higher concentrations. The concentrations of copper in the regenerated solutions by using NaCN regenerant were considerably greater when a dual ion exchange scheme was used than for the case of a single anionic exchange system. (Compare regeneration of copper in Runs 31 and 34 with Runs 15 and 16).

The treatment of dilute copper solution either with a weakly acid cation exchange resin only or with a weakly basic anion exchange resin in series was unsatisfactory since it allowed leakage of copper in appreciable concentrations (see Runs 29 and 30).

3. Silver plating solution

The first investigation on the treatment of a dilute silver cyanide solution by ion exchange was done with a single anion exchange resin containing hydroxyl groups. The free cyanide and silver cyanide complex ions were readily and completely removed until a break-through point was reached. It was then attempted to recover the silver by regenerating the resin with concentrated potassium cyanide solution (72,000 ppm CN). No silver was regenerated. On the basis of the theory previously expounded with reference to the regeneration of copper by the cyanide ion, silver would hardly be expected to behave similarly to copper since only one stable complex ion of silver and

TABLE III. EXHAUSTION AND REGENERATION EXPERIMENTS

B$_1$—Cuprous Cyanide Solutions—Single Anion Exchange Treatment

	Anion Exchange Effluent			Regeneration Effluent					
Run No.	Cu ft/ cu ft of Resin	Total CN, ppm	Lb of CN/ cu ft of Resin before break-through	Cu ft/ cu ft of Resin	Total CN, ppm	Cumulative Total CN, ppm	Total CN Regenerated lb/cu ft of Resin	Total CN Regenerated, Per cent	Lb of CN Regenerated/ 100 lb of Regenerant
11†	0–32.5	< 0.1	0.495	0–4.11	< 200	—	—	—	—
	32.5–48.5	0.6							
	48.5–64.3	4.5							
	64.3–66.4	—							
12†‡	0–31.8	0.1	0.40	0–0.318	76	—	0.217	—	—
	31.8–47.7	15.0		0.318–0.635	365	365		2.54	—
	47.7–58.2	38.0		0.635–1.59	747	651		9.52	0.62
				1.59–3.82	1190	998		28.9	0.68
13†‡§	—	—	Saturated with CN	0–0.318	400	400	0.206	—	—
				0.318–1.59	1155	1000		—	0.178
				1.59–3.52	880	938		—	0.136
14†	0–95.2	< 0.2	1.19	0–0.507	—	—	0.319	—	—
	95.2–111	1.0		0.507–1.84	2290	2290		13.7	2.06
				1.84–3.16	995	1650		19.7	1.48
				3.16–4.85	460	1184		23.2	1.07
15•	0–76.1	< 0.2	1.15	0–0.318	298	—	1.64	—	—
	76.1–92.0	0.2		0.318–1.59	11,950	11,950		—	10.85
	92.0–113	7.8		1.59–3.68	2730	7080		—	6.44
				3.68–6.1	956	4500		—	4.08
					Cu	Cu	Cu	Cu	Cu
				0–6.4	1300	1290	0.66	53.1	1.67
				6.4–11.35	699	928		73.7	1.30
					Cu	Cu	Cu	Cu	Cu
16	0–57	< 0.2	1.15	0–0.794	472	472	0.92	2.2	—
	57–101.5	< 1.0		0.794–2.38	3900	2760		39.2	2.0
				2.38–5.62	1660	2125		70.8	1.54
				5.62–8.85	865	1670		87.7	1.21

†No regeneration of copper.

‡NaCN–Na_2CO_3 solution with same ratio of CO_3^{--} to CN^- as in copper plating solution.

§Cyanide passed through until concentration of CN in effluent was equal to concentration of CN in influent.

•Resin regenerated first by NaCN to exchange the copper, then by NaOH to exchange the cyanide.

▲This includes some of the copper which was not regenerated in the previous run.

cyanogen is known, i. e., $Ag(CN)^-_2$.

The same resin was regenerated with 2.77 N NH_4OH. Only free cyanide was recovered and in relatively low concentrations.

The recovery of the silver cyanide complex from a strongly basic anion exchange resin by using a caustic solution had been attempted by another investigator[14] and it had been found that the complex was difficult to regenerate. However, a weakly basic anion exchange resin (Amberlite IR-4BO) on the sulfate or acetate form exhibited capacities of 0.88–.55 lb of silver/cu ft of resin and approximately 85 per cent of the silver ion was recovered by regenerating with about 20 lb of NaOH/cu ft of resin[14] (3.74–6.6 lb of Ag/100 lb NaOH).

The next phase of the investigation was directed towards the treatment of a silver cyanide solution with a cation-anion exchange resin system as for the treatment of waste cyanide solutions containing zinc. However, in this particular case it was decided that it was not strictly necessary to recover silver in a form which could be immediately reused in electroplating operations as long as the regenerated solution was concentrated enough to make it feasible to recover the silver by any widely practiced industrial process.

It was also decided to investigate cationic exchange only since the anionic exchange of HCN would be the same as in previous similar cases. The results obtained in the investigations following are reported below:

(a) The silver cyanide complex was

TABLE III. EXHAUSTION AND REGENERATION EXPERIMENTS

B_3—Cuprous Cyanide Solutions—Cation and Anion Exchange Treatment

	Cation Exchange Effluent		Anion Exchange Effluent			Regeneration Effluent					
Run No.	Cu ft/ cu ft of Resin	Total Cu, ppm	Cu ft/ cu ft of Resin	Total Cu, ppm	Lb of Copper cu ft of Resin before break-through	Cu ft/ cu ft of Resin	Total Cu, ppm	Cumulative Total Cu, ppm	Total Cu Regenerated lb/cu ft of Resin	Total Cu Regenerated Per cent	Lb of CN Regenerated/ 100 lb of Regenerant
29*	0–8.25	—	0–8.25	316	—	0–1	2200	2200	0.257	46.4	1.98
						1–2.03	1900	1975		84.3	1.78
						2.03–3.17	192	1295		86.4	1.16
30	—	—	0–3.97	470	—	—	—	—	—	—	—
31	0–3.97	13.7	—	—	—	0–0.51	1200	1200	0.813	2.8	0.82
	3.97–19.8	27.4	—	—	—	0.51–1.62	9800	7100		55.0	5.16
	19.8–27.8	37.8	—	—	—	1.62–2.22	2620	5870		62.6	4.33
	27.8–35.8	92.8	—	—	—						
33	0–15.9	6	—	—	—	0–2.19	2450	2450	*1.63	19.6	2.40
	15.9–31.7	15	—	—	—	2.19–5.75	3570	3140		66.1	3.08
	31.7–40.5	61	—	—	—	5.75–9.78	1455	2450		87.6	2.40
	40.5–44.5	158	—	—	—	9.78–11.42	870	2290		96.4	2.26
34	0–17.5	—	0–17.5	<3†	—	0–1.43	6810	6810	1.99	30.5	5.05
	17.5–34.4	—	17.5–34.4	<3†	—	1.43–2.7	16,000	11,150		94.1	8.22
	34.4–45.6	—	34.4–45.6	<3†	—	2.7–5.06	818	6320		100.0	4.64
				CN	CN						
35	—	—	0–15.9	1.5	0.9	0–3.17	2290	2290	0.78	57.3	1.68
			15.9–19.8	6.25	—	3.17–6.23	1080	1695		83.2	1.23
						6.23–9.26	429	1280		93.5	0.94
						9.26–12.6	182	987		98.4	0.72

18a. Silver regenerated by NH_4OH. No further regeneration of silver by HCl.
19b. No regeneration with KNO_3. Silver regenerated by NH_4OH.
21d. No silver regenerated by NH_4OH, Silver regenerated batchwise by NaOH+NaCN solution.
22e. Very little silver regenerated by NaOH. Silver regenerated by NaCN.
23f. No silver regenerated with $Ca(NO_3)_2$. Silver regenerated by NaCN.
17g. Anionic resin used. No regeneration with KCN. Subsequent regeneration with NaOH gave CN and Ag.
*Ratio of Cu/CN in anionic effluen = 0.61.
Ratio of Cu/CN in original influent = 0.63.
Initial *p*H = 10.75, Cationic effluent *p*H = 6.9. Anionic Effluent *p*H = 10.25.
†CN in effluent: <0.1, 0.2, 0.8.

completely decomposed into silver ion and HCN during the cationic exchange on a hydrogen form of resin. The regeneration of the resin with ammonia gave a fairly concentrated effluent and a silver recovery of about 50 per cent (Runs 18, 20). A successive regeneration of the resin with hydrochloric acid (10 per cent) did not regenerate any silver (Run 18).

(b) A potassium nitrate solution did not regenerate the silver ion. A successive regeneration with ammonium hydroxide again gave a fairly concentrated effluent and a silver recovery of 50 per cent (Run 19).

(c) A silver nitrate solution was treated with the cation exchange resin. The silver was completely removed in the exhaustion cycle. However, regeneration of the resin with 2.77 N NH_4OH did not yield any silver (Run 21). This somewhat unexpected result gave a clue as to the possible mechanism of silver regeneration by ammonia in the previous cases and the reason for the extent (about 50 per cent) to which it had been recovered.

The silver recovered in the previous runs was probably adsorbed or precipitated on the resin in the form of silver cyanide as evidenced by a white band traveling down the resin bed during the treatment of the solution. As soon as this band reached the bottom of the bed silver began to leak through. The band also increased in height, as it traveled downward, to about half the height of the resin bed.

There is also some information in the literature[18] which describes the ion exchange of silver ion on a cationic exchange resin as involving adsorption as well as ion exchange. It is therefore conceivable that such adsorbed silver reacts with some of the free cyanide forming insoluble silver cyanide. It is also possible that silver

TABLE III. EXHAUSTION AND REGENERATION EXPERIMENTS

C.—Silver Cyanide Solution

Run No.	Cation Exchange Effluent			Regeneration Effluent						
	Cu ft/cu ft of Resin	Ag, ppm	Lb of Ag/cu ft of Resin before break-through	Cu ft/cu ft of Resin	Ag, ppm	Cumulative Ag, ppm	Ag Regenerated lb/cu ft of Resin	Ag Regenerated Per cent	Lb of Ag Regenerated/100 lb of solid Regenerant
18[a]	0–52.4	<0.1	2.18	0–0.412	42	—	1.04	—	—
				0.412–2.8	3430	2900		33.4	6.04
				2.8–4.38	4840	3670		41.7	7.78
				4.38–7.54	173	2350		48.2	5.0
19[b]	0–31.7	<0.1	2.62*	0–0.476	0	0	0.79	—	—
				0.476–1.28	8250	8250		16.0 28.3†	17.6
				1.28–2.98	3200	5400		29.3 51.8	10.4
				2.98–3.62	750	4000		30.2 53.3	8.7
20	0–31.7	<0.1	3.32*	0–0.318	0	0	0.72	—	—
				0.318–1.415	1150	1150		5.0†	2.42
				1.415–3.25	4820	3460		40.5	7.29
				3.25–5.00	1200	2620		49.3	5.55
21[d]‡	0–95	<0.1	4.4	—	—	—	4.35	—	—
				0–0.725	0	0		—	—
				0.725–2.3	1250	1250		6.73	1.28
22[e]	0–44	<0.1	2.05	0–0.49	865	—	1.63	1.3	—
				0.49–1.33	31,600	31,600		76.4	23.7
				1.33–2.26	1160	14,700		79.7	10.6
23[f]	0–43.7	<0.1	2.45*	0–0.436	270	—	2.34	—	—
				0.436–1.53	31,300	31,300		94.5	25.5
				1.53–2.45	258	—		95.5	—
				2.45–3.8	0	—		95.5	—
		CN	CN		CN	CN			
17[g]	0–47.6	<1.0	2.98	0–0.84	646	646		—	—
	47.6–63.5	>1.0	—	0.84–2.43	1200	1010		—	—
	63.5–80.2	>1.0	—	2.43–5.6	748	860		—	—

*It includes some of the silver on the resin from the previous runs.

†Per cent of freshly exchanged Ag.

‡$AgNO_3$ solution containing 735 ppm Ag—Fresh resin used.

cyanide begins to precipitate as soon as most of the hydrogen ions have been exchanged in the section of the resin taking active part in the exchange of ions, since the *p*H is not low enough to decompose completely the silver cyanide complex.

As soon as all of the hydrogen ions have been exchanged in one particular section, the band moves since alkaline *p*H and the presence of free cyanide flowing down the resin bed cause the silver cyanide to redissolve. The action of ammonium hydroxide on silver cyanide can be explained readily on the basis that the latter is very soluble in ammonium hydroxide because of the formation of a soluble ammonium silver cyanide complex.

The resin containing silver from Run 21 was treated batchwise in three stages with a sodium hydroxide-sodium cyanide solution. More than 97 per cent of the silver was recovered, whereas by treatment with sodium hydroxide alone no silver was recovered. These results indicated that the silver was exchanged by the sodium ion and was brought into solution by the cyanide ion.

(d) The same regenerating scheme as (c) was tried with a flow process with excellent results as shown in Runs 22–23. Regeneration of the silver with calcium nitrate was also attempted but no silver ion was recovered.

D. *The Anion-Cation Exchange Resin System*

It has been shown in the preceding dis-

cussion how a strongly acidic cation exchange resin placed in series with a strongly basic anion exchange resin can be used to treat satisfactorily cyanide solutions containing the free cyanide ion or the anion cyanide complexes of monovalent copper, zinc and silver. It has also been shown how a regenerant containing the cyanide ion can be used in all cases to regenerate successfully the metal cations which have been either exchanged or adsorbed on the cation exchange resin.

In most cases a sodium cyanide solution has been used to regenerate the cation exchange resin separately, while a sodium hydroxide regenerant has been used to regenerate the anion exchange resin. This method of regenerating the resin separately was adopted to study the individual behavior of each resin. In actual plant practice the two resins need not be regenerated separately and a fresh cyanide solution need not be used for regeneration. A sodium hydroxide regenerant solution would be passed through the anion exchange resin at first to regenerate the free cyanide; the regenerated solution would then be passed through the cation exchange resin where the metal cation is exchanged by the sodium ion and is kept in solution by the cyanide ion.

E. *Additional Information*

The results of the regeneration runs as shown in Table III are based on a single regeneration cycle, the regenerant having been used only once. Therefore, the concentration of regenerated ions as reported in the above table should not be interpreted as being the maximum concentrations that can be obtained in the regenerated solutions. If the regenerated solutions were reused for successive regenerations the concentration of the regenerated ions would increase; however, the efficiency of regeneration would decrease with successive cycles. A choice of the number of cycles in which to use the same regenerant would probably be based mainly on economic considerations and ease of operation.

It may be noticed in examining Table III that the resins were never completely regenerated. This does not mean that only a certain percentage of the exchanged ion can be recovered by regeneration but it means that only a given percentage of the total capacity of the resin can be regenerated economically. If the concentration of the desired ions in the regenerated solution is plotted against the volume of the regenerant used the type of curve shown in Fig. 5 is usually obtained:

In the above curve A represents the peak concentration, after which the concentration suddenly drops and the regeneration is stopped at B because the regenerated effluent is becoming too dilute to

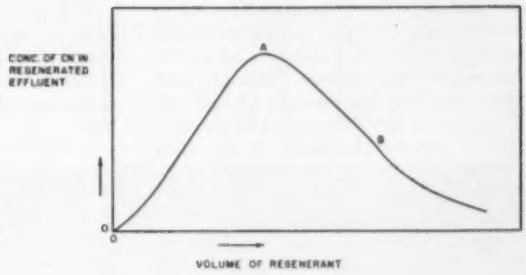

Fig. 5. Ion Exchange Regeneration Cycle

TABLE IV. RESULTS OF TREATMENT OF DILUTE METALLOCYANIDE SOLUTIONS WITH DUAL ION EXCHANGE METHOD*

	Zinc Cyanide Solution	Copper Cyanide Solution	Silver Cyanide Solution
Volume of solution treated before regeneration—gal/cu ft of anionic resin	6,000	4,800	4,500
Concentration of total CN and metal in treated effluent—ppm	0.1	0.2	0.1
Total CN exchanged on anionic resin—lb/cu ft of anionic resin	1.0	0.8	0.75
Metal exchanged on cationic resin—lb/cu ft	0.72†	1.8	2.2
Volumetric ratio of cationic resin to anionic resin—cu ft/cu ft	0.92	0.35	0.35
Volume of alkaline regenerant‡—gal/cu ft of anionic resin	17.2 NaOH	17.2 NaOH	17.2 KOH
Concentration of cyanide in regenerated alkaline effluent—oz/gal	1.5 NaCN	1.5 NaCN	2.0 KCN
Concentration of metal in regenerated alkaline effluent—oz/gal	0.55	0.65	1.1
Concentration of alkali metal hydroxide in regenerated alkaline effluent—oz/gal	4.8 NaOH	4.2 NaOH	5.6 KOH
Volume of acid regenerant—gal/cu ft of cationic resin§	5	5	5

*The treatment of dilute cyanide (20 ppm per cent) plating solutions by a strongly acid cation exchange resin (Resin A) and a strongly basic anion exchange resin (Resin E or G) placed in series.

†Calculated by assuming the percentage total capacity of the cationic resin to be the same as that of the anionic resin.

‡NaOH regenerant × 5.92 oz/gal
KOH regenerant × 9.2 oz/gal

§Sulfuric acid solution used containing 7.25 oz of H_2SO_4 per gallon
Height and diameter of bed approximately equals
Superficial Velocity of solution in exhaustion cycle = 0.12–0.16 ft/min
Superficial Velocity of regenerant 0.05 ft/min
NOTE: 1 oz per gal = 7.48 g per liter = 7,480 ppm

be reusable. Therefore in the first regeneration only a certain percentage of the exchanged ions are recovered, but in the successive regenerations following each exhaustion run the recovery of ions will be complete and only a certain percentage of the total capacity of the resin is used.

It should be added that the acid regenerant to be used for the regeneration of the cation exchange resin need not be hydrochloric acid. It is believed that sulfuric acid would be equally satisfactory.

Conclusions

Very dilute copper, zinc and silver plating solutions (20–1000 ppm total CN) were treated by an ion exchange system consisting of a strongly acid cation exchange resin (hydrogen type) placed in series with a strongly basic anion exchange resin (hydroxyl type).

The dual ion exchange scheme was found to be more satisfactory than the single anion exchange treatment mainly because the ions exchanged were recovered by regeneration in a more concentrated form.

The treated effluents contained in most cases less than 0.1 ppm of total CN and less than 0.2 ppm of metal ions.

The resins were regenerated in most cases by a 2.7 N (about 10 per cent by weight) sodium hydroxide solution and the cation exchange resin was regenerated a second time with 2.7 N hydrochloric acid solution (about 10 per cent by weight) to convert the resin to the hydrogen form.

The cyanide and metal ions were regenerated to concentrations varying between 5,000 and 30,000 ppm.

Neither the chemical and physical stability of the resins nor the exhaustion and regeneration efficiency of the resins after repeated cycles was investigated.

The tabulation shown in Table IV gives an indication of the results that can be obtained by treating dilute metallocyanide solutions with a strongly acid cation and a strongly basic anion exchanger placed in series (see Fig. 4). These are calculated results based on the laboratory-scale experimental results presented in this paper.

The solutions chosen for this demonstration contained 20 ppm of total CN (as CN) and they have been obtained by dilution of concentrated solutions with the same composition as shown above. If weaker or more concentrated solutions were treated the extent of removal of ions would be the same as for the solutions shown in Table IV with the exception that the volumes that can be treated per unit volume of resin vary inversely with the concentration of total CN. Thus the same volume of resin can be used to treat either one gallon of a solution containing 20 ppm of total CN or one-half gallon of a solution containing 40 ppm of total CN.

Additional data necessary for plant design or operation include amounts of rinse water needed.

The following steps are suggested for each complete cycle of ion exchange operation:

1. Passage of dilute cyanide solution through a cation exchanger and an anion exchanger with consequent removal of cyanides and metals.
2. Regeneration and recovery of cyanide and metals in a more concentrated form by passing an alkali-metal solution through an anion exchanger and a cation exchanger.
3. Rinsing of both ion exchangers with some of the treated effluent until cyanide-free (<1 ppm total CN) rinses are obtained. These rinses should be mixed with the dilute cyanide solution to be treated in the following exhaustion cycle.
4. Regeneration of the cation exchanger only, with acid.
5. Rinsing of the cation exchanger with treated effluent until the rinse has a *p*H value greater than 5.0.
6. The treated effluent which is not used for rinsing can be substituted for ordinary water in plating operations with some advantage since it is demineralized water.

It will be noticed in the Table (IV) that an excess of either sodium hydroxide or potassium hydroxide is present in the regenerated solution. If the hydroxide ion is objectionable in those solutions which ordinarily contain the carbonate ion, the hydroxide ion may be converted to carbonate by adding a stoichiometric quantity of bicarbonate.

The regenerated solutions are of course not concentrated enough to be reused directly for plating and additional cyanide reagent would have to be added.

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Washington Orders

Aluminum.—The DPA has announced that an extra 44 million pounds of aluminum, in addition to the 77 million pounds arranged for last fall, will be delivered during February and March to the United States by the Aluminum Company of Canada.

This additional metal will help offset domestic production losses due to recent power shortages. Meanwhile, relief from a substantial amount of paper work was permitted by an amendment, dated January 23, to M-5, the basic aluminum order.

Cobalt.—A revised expansion goal calling for a total U. S. supply of 27 million pounds of cobalt by 1955 was announced by the DPA. The new goal is 17 million pounds more than the U. S. supply of 10 million pounds in 1950. The consumption of this metal reached a new high in this country of 9.9 million pounds in 1951—a gain of 20 per cent over the former record year of 1950.

List of Basic Materials and Alternates—In list No. 10, dated December 28, there was shown a reduction of thirteen materials from the "most critical" category listing of 24 materials covered during the preceding twelve month period. Under metals, electrolytic manganese is added to Group I (in short supply) and tungsten, formerly in Group I, is now in Group II (in approximate balance). Carbon disulfide is one of eight chemicals moved from Group II to Group III (in fair to good supply).

Among those materials removed from the list because supplies are now adequate are carbon tetrachloride, emery, pumice and tripoli.

Nickel—The OPS on January 9 authorized a ceiling price increase of 3½ cents a pound for primary nickel sold by the seven domestic wholesale distributors of the metal in order to permit them to maintain their customary pre-Korea markup as required by law.

Any lowering of the permissive use of this metal below the presently allocated percentage listed in NPA order M-80 was the subject of a meeting of the Silver-Plated Flatware IAC. Further reductions in the use of the metal by the industry, predicted by the NPA, was pronounced by the IAC as a step that would result in an inferior product which in turn would seriously jeopardize the industry. NPA assured the group that no immediate cut in nickel supplies to the industry is contemplated.

Platinum.—A ban on primary platinum exports was recommended by the Platinum Industry Advisory Committee to the NPA. The IAC also advised that the metal thus saved be made available to the jewelry industry as new metal.

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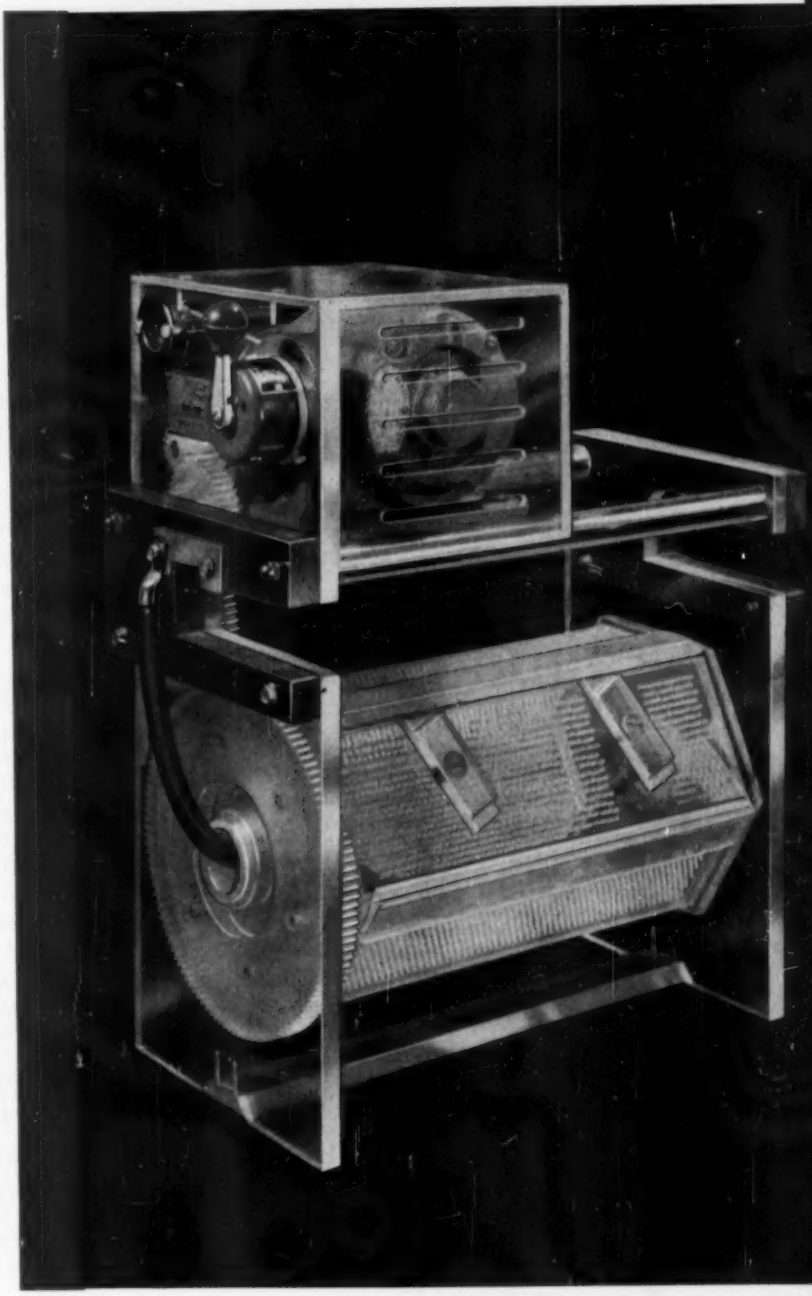

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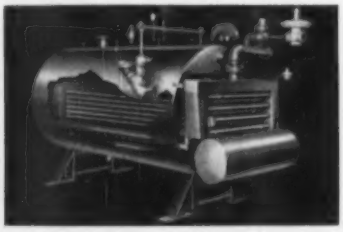

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readers' questions of general interest

Q. 154. We are interested in obtaining a standard commercial specification for nickel chrome plating on carbon steel to be used as a mirror. In conjunction with this we desire one that will stand up under a salt spray test of reasonable duration.

A. We know of no specification covering nickel-chrome plating of carbon steel mirrors, nor do the authorities we have consulted. Ordinarily, mirrors are electroformed over a polished mold and we question the advisability of nickel-chromium plating steel forms.—D. G. FOULKE.

Q. 155. Lately we have had many troubles in the chromium plating of phonograph record matrices. We checked amperage, temperature, chemical concentration of the bath, etc. We eliminated impurities—by working the tank at a very low amperage with a dummy matrix but we still do not get good work. Please list the causes of incorrect chromium plating with your suggestions for correcting each condition.

A. As the trouble they are having in chromium plating phonograph record matrices is not described in detail, the best that can be done is to make a few general suggestions. Their trouble is more likely to be found in racking and cleaning than in the plating bath and plating conditions. It is suggested that they have their racks insulated and use several spring contacts so that practically all the current registering on the ammeter goes to the surface to be plated. They should use a cone-shaped anode to distribute the current uniformly. They should check to be sure that they did not base their current density on the area as measured with a rule. The actual area being plated is two or three times the measured area because of the ridges on the matrix.

It is also suggested that they check the handling and cleaning of the nickel or copper plate on the matrix to be sure that it is not partially passive when it goes into the chromium bath. Passivity may cause a non-uniform chromium plate. If they use a hydrochloric acid dip, they should analyze the chromium bath for chloride to check on the possibility that dragin of chloride may be one cause of the trouble.

Electrolyzing the chromium bath does not remove impurities such as iron and copper, although it does decrease the trivalent chromium content, provided the anode area is several times the cathode area.—J. M. HOSDOWICH.

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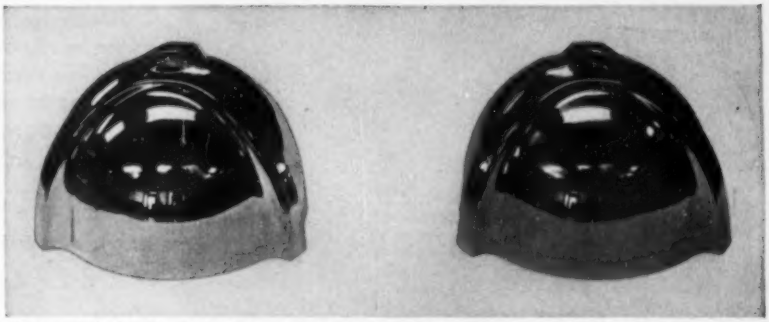

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No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

The Problem of Hydrogen Diffusion in the Pickling of Spring Steel. J. S. Jackson, J. Electrodepos. Tech. Soc., **28**, 89–101 (1952).

The known facts and the theories about diffusion of hydrogen into steel are discussed, including the effects of various factors on the properties of the steel. Graphs, tables, and photographs are presented. It is concluded that it is far more satisfactory to prevent occlusion of hydrogen in the first place than to attempt to remove it later. Attempting removal by low-temperature heat treatment is never fully satisfactory, even before plating; and it is doubtful whether hydrogen can escape through a layer of electroplated metal.—*Lyman B. Sperry.*

Investigations of Electrolytic Polishing. S. Tajima. Metalloberfläche **4**, B54–B58 (April, 1952); B73–B75 (May, 1952). Light Metals Bull. **14**, 787 (October 3, 1952).

The author surveys the research on electrolytic polishing of metals carried out in Japan during the war and immediate post-war years during which time information from abroad was completely cut off. Compositions of baths and operating conditions for treating aluminum and its alloys (phosphor acid + agar agar and caustic soda + casein baths), iron and steel, stainless steels, copper and copper.

Some Factors in Spray-Silvering. P. B. G. Upton, G. W. Soundy and G. E. Busby. J. Electrodepos. Tech. Soc. **28**, 103–113 (1952).

An excellent, detailed description of one particular spray-silvering process now in use. The surface to be

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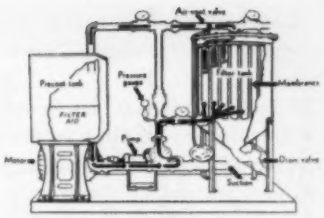

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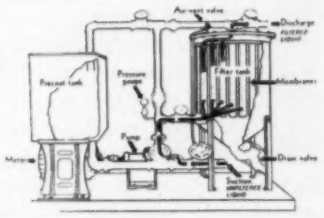

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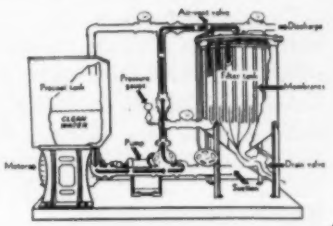

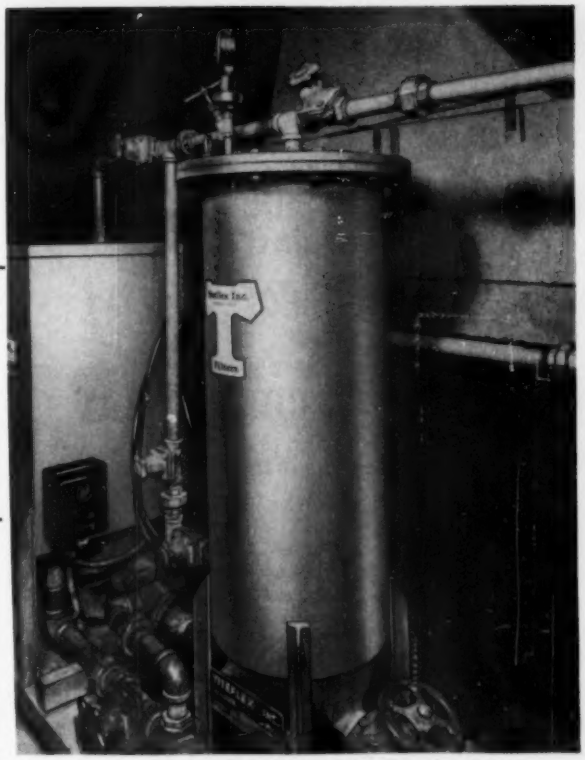

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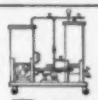

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Article Abstracts

treated, which may be hydrophobic, is immersed for a few seconds in a stannous chloride solution containing an anionic detergent. This produces a hydrophilic surface film, of a basic stannous compound, making it possible to spray-silver a much greater variety of materials. A special gun (photographs) is used to spray, in an intimate mixture, two solutions (a 2.4 per cent silver ammonionitrate solution, and a 3 per cent formaldehyde solution) on the specially prepared surface. Thickness of the silver deposit increases in direct proportion to the spraying time, after somewhat more rapid deposition during the first second or two. Other factors, such as rate of solution flow, distance of the gun from the work, etc., may also influence the amount of silver deposited.

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The spray-silver deposit is, of course, used as a base for decorative electroplating. Tables and graphs are presented.—*L. B. Sperry.*

Metallization of Surfaces by Evaporation in Vacuum. L. Dunoyer. C. R. Acad. Sci. **233,** 919–921 (1951). Br. Abstrs. **B1,** 1430 (Oct. 1952).

The metallization of a glass surface with aluminum is described. The surface is cleaned by bombardment with thermionic electrons accelerated by an electric field. The heating system is a spiral filament in a cone or a cylinder, on which a piece of the metal to be vaporized is placed. The use of a tantalum filament is preferred, since tungsten becomes very brittle at the high temperature involved. The aluminum layer is soft, but when pressed with a chamois cloth or fine linen it is hardened so that it can only be scratched with difficulty by a steel needle.

Hard Chrome Plating Aluminum. E. Mayer-Rässler. Metal Ind. (Lond.) **81,** No. 7, 127–129 (1952). C. A. **46,** 10963 (Nov. 25, 1952).

Chromium plating on aluminum is usually for the purpose of improving wear resistance on such parts as engine cylinders, pistons, brake drums, and cock plugs. Because of the hard, brittle properties of chromium, shock or excessive temperature changes should be avoided. Surface-preparation methods include (a) pickling in alkali; (b) pickling in alkaline $Zn(OH)_2$ solution; (c) pickling in an acid solution of iron perchloride; (d) pickling in an acid solution of $NiCl_2$; and (e) pickling in an acid solution of $CuCl_2$. The

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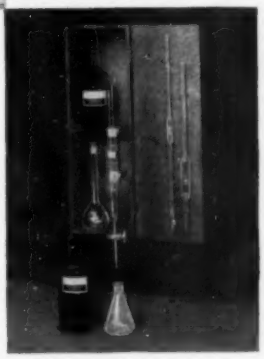

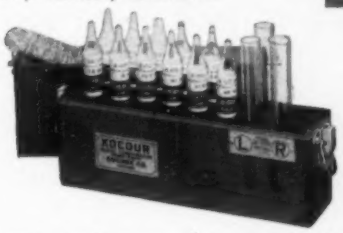

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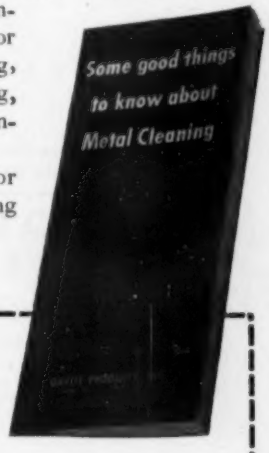

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Article Abstracts

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The Prediction of Optimum Conditions for Electropolishing. L. Meunier. Galvano **21**, No. 188, 15–21 (September, 1952).

The theory of electropolishing and anodic polarization curves is discussed and a bibliography of 33 references given, some of which have appeared in the "Proceedings of the Third Meeting (Bern, 1951) of the International Committee of Electrochemical Thermodynamics and Kinetics (C. I. T. C. E.)".

Darmois and his collaborators have correlated optimum cell voltage V and optimum current density I in perchloric acid electropolishing baths with the maximum apparent cell resistance $R_m = \frac{V}{I}$, and optimum bath concentration with the maximum of the curve of the R_m values plotted versus concentration. Also direct correlation of optimum bath concentration with maximum electrolyte resistivity was attempted.

Other points of interest are:

In certain cases of electropolishing moderate oxygen evolution causes pitting, whereas stronger anodic gassing is harmless or even useful.

Even traces of chloride ions are in most cases harmful for electropolishing, but a chloride bath for electropolishing of nickel has recently been reported (Tajima and Mori, Comptes Rendus **233**, 160, 1951).

Studies on electropolishing of zinc in alkali hydroxide gave the following results:

0.1 N KOH produces only an insulating white oxide film;

1.0 N KOH a more conducting black film;

further increase of the KOH concentration reduces progessively the anodic film thickness and creates finally electropolishing conditions.

Increase of bath temperature and agitation act similarly to increased concentration.

Copper and cadmium cannot be electropolished in alkali hydroxide, due to the very low solubility of their anodic hydroxide films in the electrolyte, but addition of ammonia to the bath makes electropolishing of copper possible (Tegat and Vines, Revue Metallurgie **48**, 245, 1951).—*Otto Kardos.*

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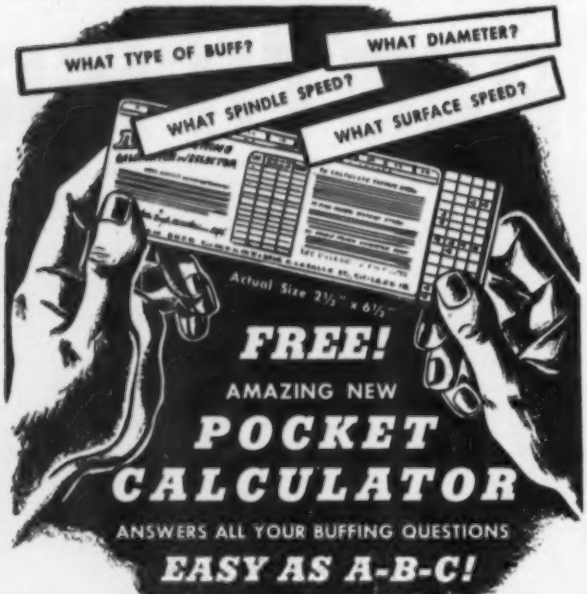

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Patent Abstracts

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No. 2,619,457, November 25, 1952—Electroplating Anode—F. W. Wagner, assignor to Wagner Brothers, Inc., Highland Park, Mich.

CLAIM 1. In an anode for an electrolytic bath, an electricity conducting shaft adapted to be suspended in the bath while connected with a source of electrical energy, a plurality of anode members and a plurality of washer assemblies replaceably strung on the shaft alternately and spacing each other, each member having a bore with the shaft passing therethrough in electrical contact with the member, each washer assembly comprising a rigid electrically conducting inner bushing in electrical contact with the members spaced thereby and the shaft, and also comprising an outer gasket having concave faces at opposite sides to provide for maximum compression axially of the gasket adjacent the outer edges of the gasket to effect a fluid tight seal around the shaft, each gasket interposed between a pair of said members being compressed there between with the degree of compression decreasing radially inwardly from a maximum at its outer edge, the uncompressed thickness of the gasket increasing radially from a thickness less than the axial thickness of the associated bushing adjacent the latter to an axial thickness greater than said bushing, and clamping means on the shaft compressing said alternating gaskets and members together to effect said seals and contact between said members and bushings.

5 claims, 3 figures.

References cited: U. S. Patents 981,004; 1,028,786. British Patents 19,368; 532,625. Italian Patent 355,863.

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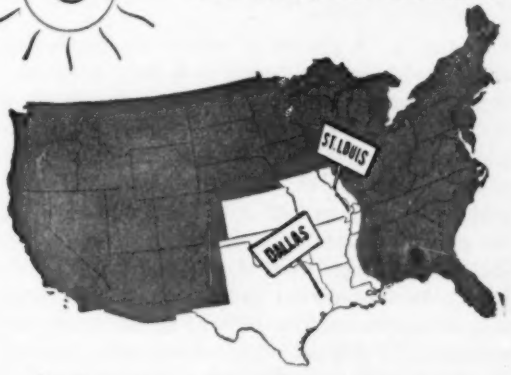

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An all-purpose chromate treatment for cadmium and zinc

HERE is a single, dry powder to be made up with water and acid to give you any one of the following finishes:

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FOR CADMIUM
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FOR BRASS—a passivating treatment.

Simple, economical, this protective finish is applied by dipping. Rinsing follows dipping except for bright zinc or cadmium which are followed by leaching. Meets all Government Specifications. No carboys to handle. No deposit. Lower shipping costs. A proven product to cut costs and give you better finishes. Write . . .

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POOR & COMPANY

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WAUKEGAN, ILLINOIS

Patent Abstracts

No. 2,621,152, December 9, 1952—Zinc Cyanide Plating Baths—Raymond A. Hoffman, assignor to Allied Research Products, Inc., Baltimore, Md.

This invention relates to the electrodeposition of zinc, and is particularly directed to processes wherein a bright mirror-like deposit is plated from cyanide zinc baths which contain substantial amounts of a soluble resinous material prepared as hereinafter described.

The materials . . . are placed in a closed vessel to which a reflux condenser is attached. Heat is applied until the mixture boils and is continued for a period of 1½ to 2 hours after which time the reaction is considered complete. The clear somewhat syrupy liquid obtained at the end of this period is ready for use as a brightener for zinc deposits from cyanide zinc plating baths.

CLAIM 5. A method for electrodepositing zinc from cyanide zinc plating baths in the form of bright-mirror-like deposits, said method comprising electro depositing the zinc from a cyanide zinc plating bath containing per liter of bath, from 0.25 to 2.0 grams of the reaction product obtained by reacting together in aqueous solution from 10 to 30 grams of ammonium thiocyanate, from 10 to 30 grams of dicyanidamide, from 4 to 15 grams of sodium hydroxide and from 40 to 100 grams of formaldehyde.

7 claims.

Reference cited: U. S. Patent 2,101,580.

No. 2,622,063, December 16, 1952—Electrolytic Production of Iron and Iron Alloys—Erik G. R. Angel, Stockholm, Sweden.

CLAIM 6. A process of electrically producing iron alloyed with another metal in a state adapted to be easily pulverized which comprises grinding an anhydrous ferro-oxygen compound together with an oxide compound of one of the metals of the group consisting of manganese, nickel, tungsten and molybdenum to a grain size less than 0.05 mm, forming a suspension of the ground material in an alkaline electrolyte containing at least 37 per cent of alkali hydroxide, and subjecting the suspension to electrolysis at a temperature of approximately 100° C to electrodeposit the metals at the cathode while continuously agitating the electrolyte and its content of solid particles to bring the latter in solution at substantially the same rate as the metals are deposited on the cathode.

LEGEND. As a current efficiency amounting to 80–85 per cent may be obtained at a cell voltage of 1.7–1.8 V, the consumption of energy amounts to not more than 2.2–3.25 kwh/kg iron.

Temperature of bath 100° C. Intense agitation.

8 claims.

References cited: U. S. Patents 884,075; 884,763; 1,275,161; 2,168,542; 2,296,757. British Patents 22,312; 28,897; 159,906; 545,057.

No. 2,623,847, December 30, 1952—Black Chromium Plating—Lloyd O. Gilbert and Charles C. Buhman.

The invention described in the following specifications and claims may be manufactured and used by or for Government for governmental purposes without payment to us for any royalty thereon.

The preferred electrolyte consists of an aqueous solution containing about 275 g of chromic anhydride and about 200 ml of glacial acetic acid per liter of solution. It has been found that the presence of the sulfate ion in the bath is deleterious to the formation of the desirable dark gray to black coating. We precipitate the sulfate by addition of small amounts of barium compound. . . .

The solution may be made up by dissolving the chromic anhydride in a small amount of water, adding the glacial acetic acid and, thereafter, adding water to the required volume.

CLAIM 4. The process of producing dark-gray to black, corrosion resistant, adherent film upon a conductive base which comprises electroplating said base in an electroplating cell in which the base is cathode and in which the electrolyte comprises an aqueous solution of from 200 g to 500 g of chromic anhydride containing acetic acid in a concentration of not less than 50 ml and not more than 450 ml of glacial acetic acid per liter of solution and electrolyzing at a temperature of about 90° F to 115° F and at a cathode current density of from 40 to 90 amperes per square foot.

6 claims.

References cited: U. S. Patents 1,233,633; 1,542,549; 1,975,239. Arndt et al, Zeitschrift fur Metallkunde, Vol. 30 (1938), 21–24. Schneidewind, Engineering Research Bulletin No. 8, University of Michigan (November, 1927), 33–34.

No. 2,624,700, January 6, 1953—Preparation of Printing Surfaces for Photography—George L. Morrison, Evanston, Ill.

CLAIM 1. The method of preparing for photographing a printing form containing printing surfaces of type metal and printing surfaces of at least one metal other than type metal, which comprises the steps of electroplating onto the printing surfaces which are of a metal other than type metal a very thin coating of a metal which when clean and polished has light reflecting properties approximately equal to clean, polished type metal, applying a light-absorbing coating to the entire surface of the printing form, removing said coating from the relief surfaces, while leaving the coating intact on the other surfaces of the form, and abrading said relief printing surfaces to produce thereon a clean, diffusely reflecting finish of sufficient fineness that the individual lines in the surface are not visible to the naked eye.

Legend. A number of metals can be used for the high reflectance coating which is applied to the print-

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PROBRITE WHITE ALLOY

A new finish to replace Nickel

HERE is a new finish which not only replaces nickel, but offers advantages not found with nickel. It plates easily over steel or copper and is readily chrome plated. Followed by new Promat Chrome Sealer it offers over 200 hours resistance to red rust! It is bright out of the bath, plates at high current densities, has excellent covering power. Make-up cost is comparable to nickel, operating cost is lower. Suitable for barrel plating and semi or full automatic still tanks. And, it looks just like copper-nickel-chrome. Complete data on request — write or call today.

CR-723 *Buffing Grade* White Alloy—for parts that can be color buffed. Any shop can handle it. Ask for details.

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NO ROUGH DEPOSITS
NO PITTING

Model LSI-10
Cap. 100 gal/hr
H.T. Lucite Filter Assembly
Portable, Wt. 40 lb.
12"x16"x16"

SETHCO FILTER PUMP LSI-10

- Filter solutions from ph 0 to ph 14.
- No loss of precious solutions.
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- H. T. Lucite, Stainless (316), Rubber-lined, Haveg or Sethrin* Resin Filter Assemblies.
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Distributors in All Principal Cities

*Reg. App. for

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Brooklyn 1, N. Y.

USE READER SERVICE CARD; INDICATE A 362.

SPEED-UP your nickel stripping with STRIPODE

PROTECT the base metal

A proved addition agent, STRIPODE strips nickel plate faster and protects the base metal from pitting, roughening and etching. Also saves on use of acid, eliminates need of sand blasting or heavy buffing operation. Try it!

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EVEN YOUR BEST FRIEND

won't tell you if your plating techniques date back to the nickel cigar—but I will! Enroll in ELECTROPLATING KNOW HOW, the easy-to-take home study course and get yourself four square on modern plating methods, fast. Pays for itself many times over. Write me today. No obligation. Joseph B. Kushner, Electroplating School, Stroudsburg 1p, Pa.

ing surfaces, which are not of type metal. These include tin, cadmium, silver, and others of the white metal group, although the use of tin is particularly preferred since this metal seems to produce a much better surface than any of the other metals.

4 claims, 6 figures.

References cited: U. S. Patents 1,098,610; 1,382,613; 1,434,798; 1,669,821; 1,922,031; 2,009,262; 2,083,249; 2,126,017; 2,354,756; 2,426,962; 2,456,608. British Patent 401,511. Clerc Ilford Manual published by Ilford Ltd., London 1946, p. 244.

No. 2,625,507, January 13, 1953—Method of Electrodepositing Nickel—S. A. Mayper, assignor to United States of America as represented by the United States Atomic Energy Commission.

CLAIM 1. A method of producing finely divided nickel having a mean particle size between 7 and 15 microns which comprises providing a solution containing nickel, ammonium and sodium ions in their respective approximate proportions of 0.1 to 1.0 to 1.0, providing a nickel anode and an inert anode in said solution, maintaining a cathode current density of from 0.05 to 0.30 amperes per square centimeter on a cathode in said solution for a time interval between 15 minutes and 3 hours, maintaining the nickel ion concentration approximately constant by adjusting the total anode current so that the ratio of current carried by said nickel anode and that carried by said insoluble anode is between 2.5 and 1.5 to 1, and maintaining the *p*H of said solution between 2.0 and 6.0 inclusive.

Legend. . . . the electrolyte comprises a water solution of one mol of ammonium chloride, one mol of sodium chloride and one-tenth mol of nickel chloride per liter.

2 claims, 2 figures.

References cited: U. S. Patents 1,461,276; 1,837,355; 2,157,699; 2,233,103; 2,316,917; 2,398,614; 2,463,190; 2,480,156; 2,481,079. "Modern Electroplating" (1942), pp. 237, 239, 242, 244, 249. Transactions, Electrochemical Society, Vol. 56 (1930), pp. 387–394, 397.

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Slightly Used BUFFS

Loose and Sewed
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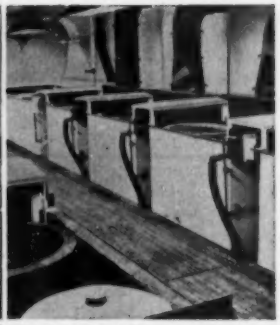
BEFORE—*Stainless steel chemical installation after 14 months' service handling corrosive acids.*



AFTER—*New unit has plenum chambers, hoods and overhead ducts built entirely of VAN DORN PLASTICS—still resistant to 30 acids after 2 years' service.*

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Highly Resistant to Acids and Alkalies • Tensile Strength of Aluminum, with 1/2 its Weight • Readily Formed, Machined, Drawn, Molded or "Welded"

For plating and metal finishing, Van Dorn fabricates its rigid non-plasticized polyvinyl chlorides into tanks, tank liners, plating racks, ducts, piping, etc. Available forms include: SHEETS 1/32" through 1"; PIPE—1/2" through 6" diameter (10 ft. lengths); ROUND BARS—1/4" through 2" diameter (10 ft. lengths); WELDING ROD—1/8" and 3/16" diameter.

Typical pipes and fittings fabricated to specifications by Van Dorn.

WRITE FOR ILLUSTRATED BULLETIN AND SPECIFICATIONS

INDUSTRIAL PLASTICS DIVISION

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POLISHING LATHES

ABRASIVE BELT FINISHING MACHINES

1500 TO 3000
1250 TO 2500
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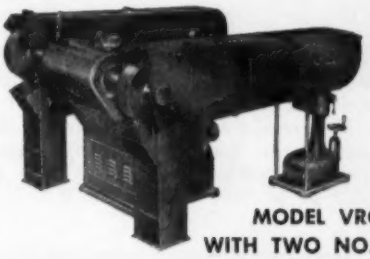
RPM INSTANTLY

DIAL CONTROL DOES IT!

MODEL VROL
VARIABLE SPEED

Turn the conveniently located dial and get spindle speed changes from 1500 to 3000 RPM instantly, while lathe is in operation. Model VROL Variable Speed, Ball Bearing, Polishing and Buffing Lathe with a spindle overhang of 8" permits handling of bulky parts without base interference.



Model VRO Variable Speed Polishing Lathe converted into a high production Abrasive Belt Unit by means of two Model 3-R Backstands. Faster, cooler cutting, increased production, more uniform finish are obtained through the use of abrasive belts.

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WITH TWO NO. 3-R BACKSTANDS

Two-spindle, two-motor, ball bearing model with motors in base, multi-V-belt drive and 8" spindle overhang. Choice of 3, 5 or 7½ HP motors and independent spindle speeds. Other models up to 25 HP.

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☆ A. E. S. NEWS ☆

Dues Increase

The tellers appointed by President MacStoker, Mr. George Wagner and Mr. George Herrmann, have reported that the amendment to the Constitution providing for an increase of dues in the amount of one dollar, the dollar to be paid into the Research Fund, has been passed by the overwhelming vote of 95 for to 28 against. This vote represents a return from ninety per cent of all the Delegates and reflects the general support of the membership for the principle that the A. E. S. should sponsor research in the field of metal finishing. This dues increase will go into effect with the 1953 fiscal year and as of April 1, 1953 the minimum annual dues will become nine dollars.

A. E. S. Constitution

The 39th Annual Proceedings of the Technical Sessions of the 1952 Convention have been distributed and each member is asked to note that the Constitution and By-Laws may be found on pages 251-266. The printing of the Proceedings was held up until the constitutional amendment vote was in (above) so that each member might have in his possession a completely up-to-date revision.

The Executive Board and Headquarters request that each member of the Society take the few minutes necessary to read the Constitution and By-Laws. The better you know your Society the better and stronger will be the Society and the better can your officers and Headquarters serve you.

I. F. E. in 1955

The Executive Board has given the go-ahead signal for the holding of the next Industrial Finishing Exposition in Cleveland in connection with the 1955 Convention by appointing Dr. Leon Westbrook as chairman of the I. F. E. Committee. Other members of the Committee include Howard Blouch, Herberth Head, R. A. Schaefer with D. G. Foulke as secretary. L. Glassner and Associates will again manage the exposition. Plan now to attend the biggest Industrial Finishing Exposition ever.

Dr. Blum To Attend Australian A. E. S. Federal Convention

On February 9, Dr. and Mrs. William Blum left Washington by plane for a four-month trip to Australia. During this trip Dr. Blum will give about 20 lectures to the A. E. S. branches in Australia and to their Institute of Metals and the Royal Australian Chemical Institute. It is hoped that these talks will serve not only to inform the electroplaters but also to interest other scientific groups in the possibilities for research in this field.

Dr. Blum will attend the Federal Convention of the three branches in Melbourne on March 18 to 20 where he will give a report on the A. E. S. researches and will show some films that depict large American electroplating plants.

Dr. Blum will also visit a number of plating and manufacturing plants in Australia, and some military establishments at the request of the U. S. Department of Defense.

En route to Australia Dr. Blum will speak to the Los Angeles Branch. In New Zealand he will speak to a few informal groups of platers, although there are no A. E. S. branches there. He expects to return to Washington about June 1, in time to attend the A. E. S. Convention in Philadelphia.

Sustaining Members

The following organizations have joined the ranks of sustaining members whose dues go to support of A. E. S. Research.

Arnold, Schwinn & Company, Chicago, Ill.

Atlas Plating Works, Cicero 50, Ill.

Bart Laboratories Company, Inc., Belleville, N. J.

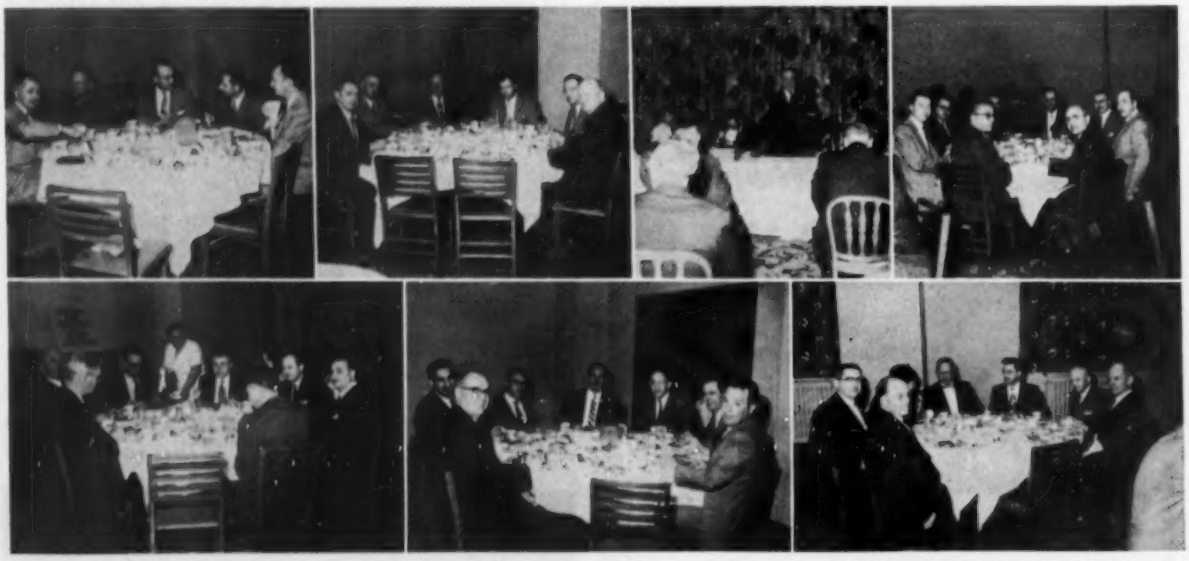
Bart-Messing Corporation, Belleville, N. J.

Metalcraft Corporation, Chicago 10, Ill.

Platers' Technical Service, Chicago 5, Ill.

Sel-Rex Precious Metals, Inc., Belleville, N. J.

Virtue Brothers Manufacturing Company, Los Angeles 45, Calif.



Photos Courtesy of Products Finishing Magazine

Delegates and Guests at the Interim Meeting at Columbus, Ohio

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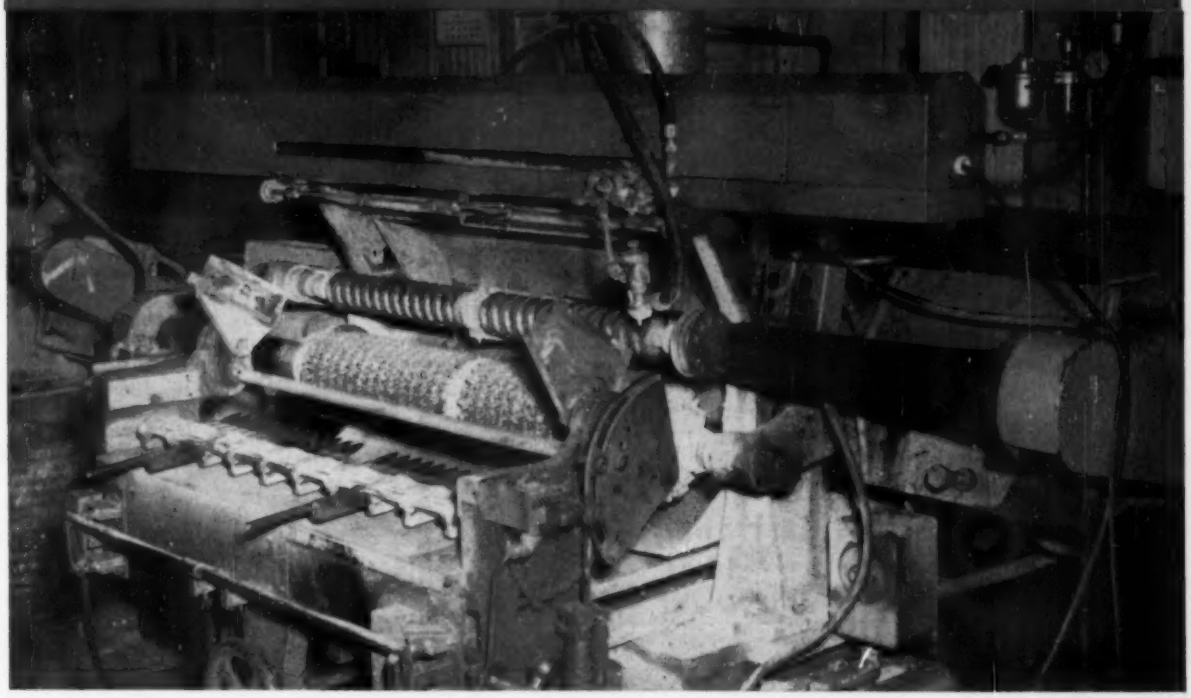

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With LEA LIQUABRADE, you are able to shift from the application of bar compound with its repetitive reheading of the wheel to what is in effect continuous operation. You save in composition and in buff wear. Operations are clean and safe. LIQUABRADE is neither inflammable nor explosive.

LIQUABRADE is available with a wide variety of abrasive types and grain sizes. It is available in 5 gallon containers, 55 gallon drums, and in tank car lots. Write us for details. Better yet, tell us about your present buffing procedure. We'll be glad to outline what LEA LIQUABRADE can do to help in improving your present practice.

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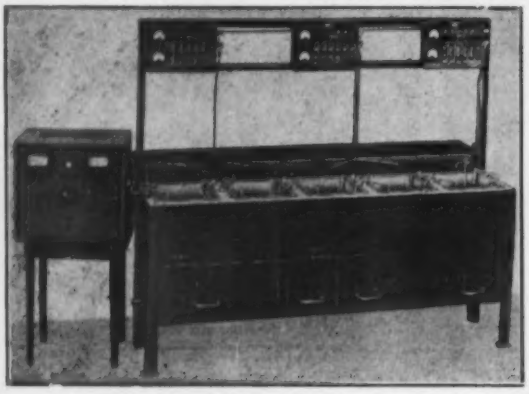
THE COMPLETE STANDARD **5 TANK** ELECTROPLATING UNIT

with RECTIFIER—Ready to Plug in and Operate



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easy to control . . . cuts down on trouble that entails costly delays.

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gives unbelievable uniformity of deposit in recesses . . . brighter, whiter color.

Write for **FREE** *bulletin revealing tricks on improving your nickel plating and cutting costs.*

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Branch News

BALTIMORE-WASHINGTON BRANCH

The annual Educational Session, coupled with a dinner and dance, took place at the Hotel Statler, Washington, D. C., on January 17. During the afternoon session three technical talks were presented. They were: "Plating on Aluminum" by HENRY PAIGE of the Aeronautical Materials Laboratory, Naval Air Experimental Station, Philadelphia; "Electrodeposition from Non-aqueous Solutions" by DR. GWENDOLYN B. WOOD of the National Bureau of Standards, Washington, D. C., and "Plating Problems for the Future" by WALTER L. PINNER, Houdaille-Hershey Corporation, Detroit.

In the evening the banquet, with over 100 in attendance, was held in the South American Room of the Statler. DR. WILLIAM BLUM served as toastmaster. PRESIDENT MACSTOKER was inducted into the "Order of the Pot" by PAST PRESIDENT KEN HUSTON. President MacStoker followed with some choice comments on the subject of the impending inauguration of President Eisenhower.

The evening was topped off by dancing to the melodies of a fine orchestra.

BRIDGEPORT BRANCH

A regular meeting was held November 14 at the Hotel Barnum. LIBRARIAN FLOYD ERLENMEYER introduced the guest speaker of the evening, B. F. AMES of Maas & Waldstein. His clear and concise presentation of various organic coatings made available to metal finishers proved most interesting.

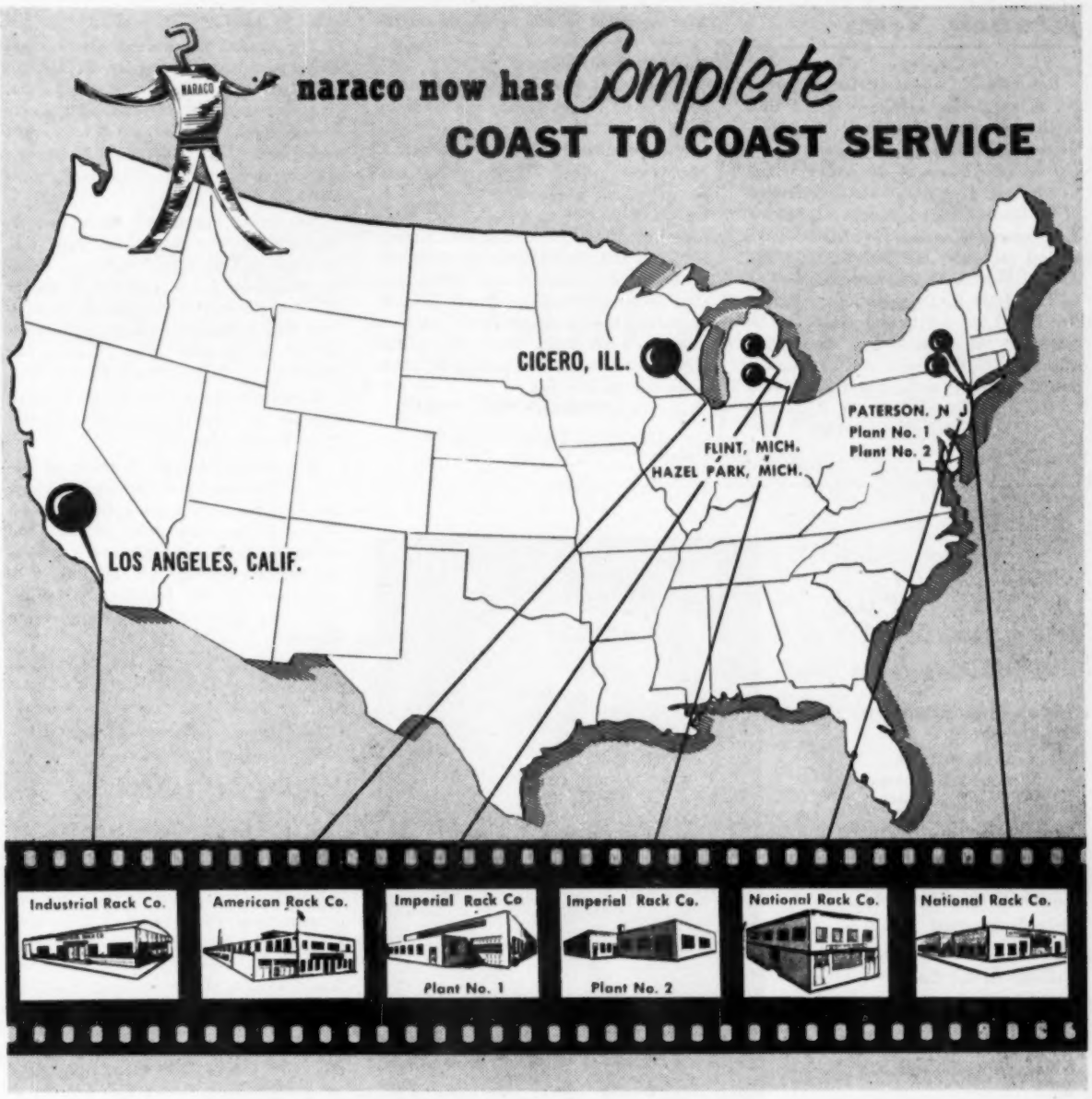
At adjournment, WILLIAM C. GILLETTE of Apothecaries Hall Company took over as host and served the highly welcome refreshments.

The annual Christmas Dinner-Dance was held at the Hotel Barnum's "Winter Quarters" on December 13, with more than 115 members and guests attending. GEORGE ECKHOLM, chairman of the committee in charge, is to be congratulated for a job well done. The program for the entertainment of the guests was highlighted by the professional touch of our long-time friend and member, GEORGE MORROW. His feats of legerdemain completely mystified the audience. Following an excellent card of variety acts procured through the efforts of ARTHUR MCNEIL, the members and guests enjoyed dance music.

BOB PARKER, *Secretary-Treasurer*

CINCINNATI BRANCH

The Branch started off the New Year with a good turnout at its meeting on January 28 at The Engineering Society Headquarters.



NARACO has had to expand their operations in order to meet with the overwhelming demands for their products. The completion of INDUSTRIAL RACK'S plant in Los Angeles, California, will enable NARACO to better serve the plating industries from coast to coast.

For many years, the skill and ingenuity of NARACO engineers in designing superior racks and fixtures to advance all plating processes has made the name of NARACO outstanding in its field.

The careful scientific manufacture of these racks and fixtures has produced the highest type quality plating for those who have used them. This "quality plating" can be had even with the most difficult processes, for NARACO has the vast experience and ability to engineer a better product.

NARACO has long been known for its extraordinary service. At each of the six plants, NARACO has brought together the finest, most experienced personnel, whose one aim is complete customer satisfaction. These men comply with NARACO'S national policy of extending every bit of man-power and plant facilities in order to meet with customer manufacturing schedules. NARACO is the name to remember not only for the superior racks and fixtures which it produces, but also for the unusual individual service it renders.

If you have a particular plating problem—or if you just want to advance the worth of your product—call the NARACO office nearest you today. One of our friendly, efficient representatives will call on you and place all of our services at your disposal.

NARACO

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3462 San Fernando Road, LOS ANGELES, CALIF.

AMERICAN RACK CO.
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IMPERIAL PLATING RACK CO. INC.
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Plant No. 2, 1000 East Ten Mile Rd., HAZEL PARK, MICH.

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Plant No. 2, 386 River Street, PATERSON, N. J.

Branch News

In connection with his letter of September 8, suggesting a change in the time of the annual convention, C. WISE presented the following as drawn by M. GLOVER, Chairman of the A. E. S. Legal Committee: THAT . . . the Constitution of the Society, Part 1, Article VI, Section 1, be amended as follows: Strike out the second sentence and substitute: "The Annual Meeting and Convention shall be held on dates agreed upon by the Executive Board and the Branch designated to entertain the Convention, hereinafter called the Host Branch". Unanimously passed by the Branch, it will be referred to the Executive Board. If it obtains their approval it will be placed on the agenda for action at the Philadelphia Convention in June.

A progress report on the Educational Session and Dinner-Dance was made by C. Wise.

MR. MILLER introduced HOWARD J. MACALEER, Formax Manufacturing Company, Detroit, whose subject was "Polish Up On Your Buffing Data". Mr. MacAleer discussed in detail the various abrasives and types of greases used in the manufacture of buffing compounds, and then gave an explanation of methods and procedures used in the making of full disc, pieced and bias buffs. His company also served as hosts for the Social Hour which concluded the meeting.

CHARLES WISE, *Secretary*

DETROIT BRANCH

The Annual Educational Meeting was called to order by PRESIDENT H. E. HEAD on December 5, in the Hotel Statler. Approximately 190 members and guests were present. The first part of a two-part color film, "The Nature of Corrosion: Anode and Cathode Processes", was shown.

NATIONAL PRESIDENT FRANKLYN J. MACSTOKER was introduced and then presided as Honorary Chairman. MacStoker introduced B. C. CASE, Manager of Research and Development, Hanson-Van Winkle-Munning Company, who delivered an original talk: "Engineering Materials for Plating Room Equipment".

EXECUTIVE SECRETARY D. G. FOULKE was the next speaker and he discussed "The National Society".

MR. R. G. CHOLLAR, Director of Research, National Cash Register Company, and Chairman of the Metal Finishing Industry Action Committee of the Ohio River Valley Water Sanitation Commission, was the third speaker. His talk, "Cooperating with the Inevitable", was an interesting discussion of plating waste disposal.

At the conclusion of the educational section, President Head thanked all participants for making it such a success.

Refreshments were served following adjournment at 10:15 P. M.

E. J. KUBIS, *Publicity Chairman*

GRAND RAPIDS BRANCH

Approximately seventy members attended the December 12 meeting. During the business part of the meeting five new members were elected: J. DORNBOS, General Motors Corp.; S. G. R. DESTEFANO, J. C. Miller Co.; E. SOUERWINE, Kirsch Co.; N. H. BRYANT, JR., Whitfield Chemical Co., and W. J. GAVIN, JR., Quaker Chemical Corp. On a motion by LYMAN SPERRY, seconded by MAURICE CALDWELL, the Branch voted to pay the A. E. S. Research Fund one dollar per member for the years 1950–1951 and 1951-1952 as the money was collected in the annual dues for those years.

Lyman Sperry started the educational session with the showing of a short movie of the JACK MILLER party held a few years ago. It was good to see the faces of the "ol' timers".

The speaker for the evening was C. F. PAULSON, Permutit Company, who presented a fine talk on "Deionizing Processes as Tools of the Plater".

Of special interest was the description of use of barium resins to remove carbonates from cyanide plating solutions. This procedure has only been developed on a laboratory basis but promises to be an important tool of the plater.

KENNETH HAMPEL, *Secretary*
CARL GREEN, *Publicity Chairman*

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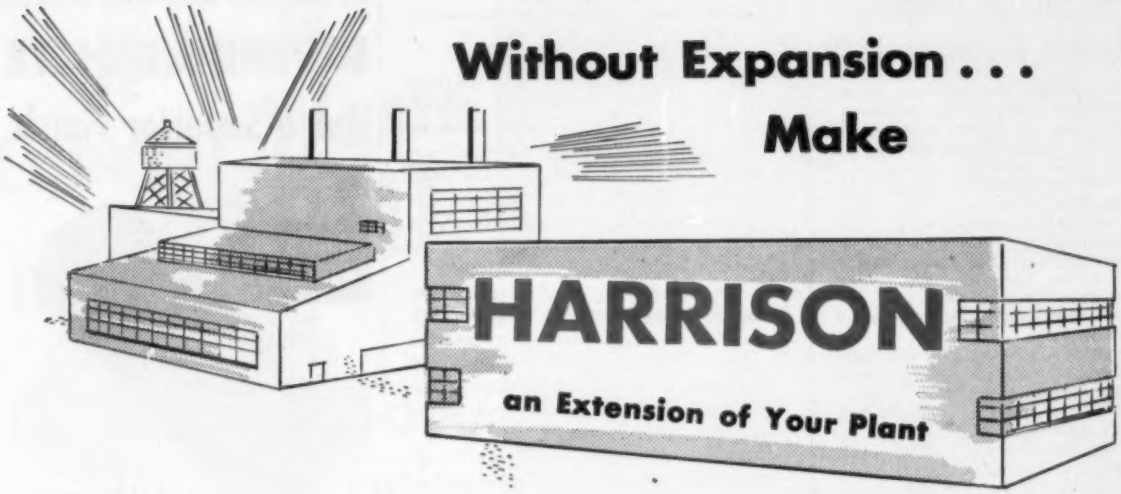

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2—5000/2500 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS**, 25° C.
1—5000/2500 AMPERE, 8/16 VOLT, **CHANDEYSSON**, 25° C.
1—5000/2500 AMPERE, 6/12 VOLT, **EAGER.**
1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON**, 25° C.
2—3000/1500 AMPERE, 6/12 VOLT, **COLUMBIA**, Synchronous.
1—2000/1000 AMPERE, 6/12 VOLT, **MUNNING** "OPTIMUS."
1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**
1—1000/500 AMPERE, 6/12 VOLT, **CHANDEYSSON.**

ANODIZERS

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON**, Exciter-in-head.
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1—1000 AMPERE, 40 VOLT, **CHANDEYSSON**, 25° C.
1—500 AMPERE, 40 VOLT, **M. G. C.**, Exciter-in-head.
1—400 AMPERE, 40 VOLT, **M. G. C.**, Exciter-in-head.
1—500 AMPERE, 25 VOLT, **CHANDEYSSON**, 25° C.

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1—10,000 AMPERE, 12 VOLT, BRAND NEW **G. E.** COPPER OXIDE RECTIFIER, with Induction Voltage Control, for 220/3/60. Can also be rated: 20,000 ampere, 6 volt; 5000 ampere, 24 volt; 4000 ampere, 30 volt; 2000 ampere, 60 volt.
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Branch News

HARTFORD BRANCH

A regular meeting was held at the Bond Hotel on January 19 with 71 members and guests present. Preceding the meeting a color film entitled "Tinplate" was shown through the courtesy of the Weirton Steel Company. Following the movie, Mr. George Hogaboom spoke briefly on "Latest Developments in the Plating Field".

The first speaker of the evening was Allen A. Cole, Daniels Plating Barrel & Supply Company, whose subject was the "Daniels Plating Barrel". He pointed out some of the salient features of the oblique type barrel as compared to the horizontal barrel.

The second speaker was Harry Walker, Richardson-Allen Corporation, whose subject was "Installation and Maintenance of Rectifiers". He gave a very interesting talk on rectification, starting with a brief history of rectifiers and described the various types now in use.

Eugene Dowling was technical chairman for the evening's program.

Stanley Platoz, *Secretary*

INDIANAPOLIS BRANCH

A regular monthly meeting was held on January 7 at the Fox Steak House. Due to the bad weather the attendance was limited. In the absence of our secretary, Herb Kennedy acted as substitute.

Our speaker, Leo Baldwin of the Indianapolis Hospital Development Association, was introduced by Bert Hawhee, Program Chairman. An excellent movie entitled "You're the Doctor" was shown following which Mr. Baldwin described the campaign which is being conducted by the Indianapolis Hospital Development Association.

Following the talk the business meeting started at 9:05 P. M. President Don Patrick advised that Arthur L. Chesterfield, former president of the Indianapolis Branch, died on December 8. A number of members attended the funeral. The Branch sent flowers and a letter of condolence.

On December 11 a meeting of the Dinner-Dance Committee was held. Roman Bender, chairman, reported that action by the various sub-committees was under way, and that another meeting of the group was scheduled after this meeting.

The meeting adjourned at 9:15 P. M.

Herb Kennedy,
Secretary Pro Tem

LANCASTER BRANCH

A monthly meeting was held at the Old Mill Inn, Lancaster, Pa., on January 16.

Thirty-two members and guests were in attendance.

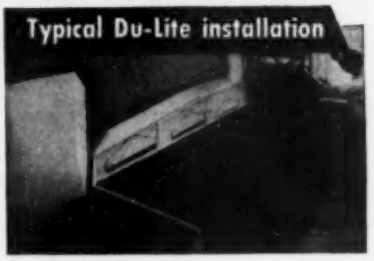
After the normal business was com-

On any steel blackening problem

DEPEND on DU-LITE for a Superior Finish

Courtesy The Poly Choke Co.

Du-Lite gave this part with its complicated knurls, slots, threads, etc. a fine rust-resistant durable black finish. It is typical of many other parts, small and large, which have been black oxidized by Du-Lite for many years. Moreover, Du-Lite meets most individual and government specifications including 57-0-2C for Type III Black Oxide finish.



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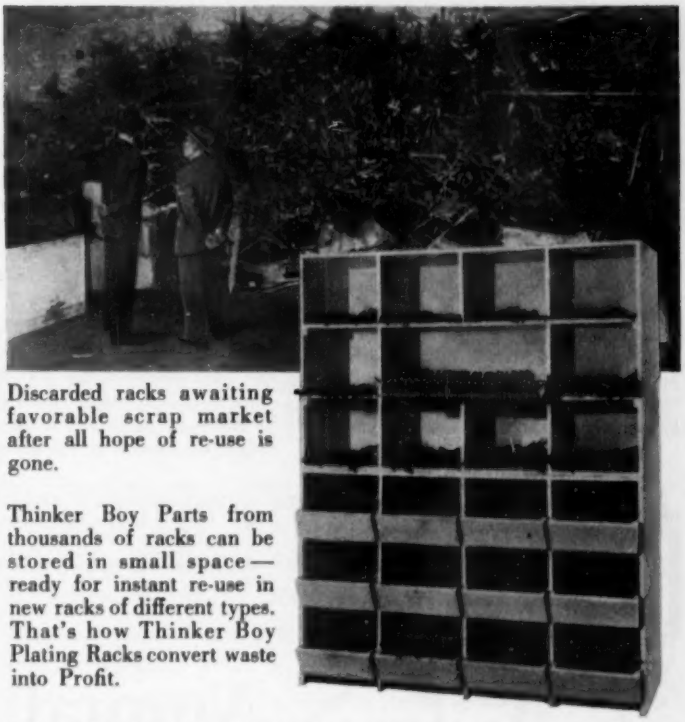
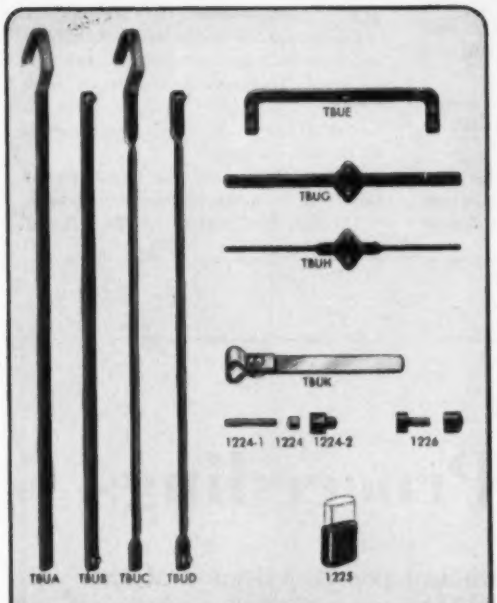
How to Convert Waste into PROFIT with Thinker Boy Plating Racks

Conventional plating racks by the thousands—stored overhead in the hope of possible re-use.



Discarded racks awaiting favorable scrap market after all hope of re-use is gone.

Thinker Boy Parts from thousands of racks can be stored in small space—ready for instant re-use in new racks of different types. That's how Thinker Boy Plating Racks convert waste into Profit.



Thinker Boy—preformed rack sections—precoated with BELKE Universal Plastic and equipped with BELKE Vac-Seal Fittings. Assemble with a leakproof seal for quick, economical manufacture of the racks you need when you need them!

Part No.	Lengths (overall)
TBUA	24, 30, 36"
TBUB	6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 30, 36"
TBUC	24, 30, 36"
TBUD	10, 12, 14, 16, 18, 20, 22, 24, 30, 36"
TBUE	6, 8, 10, 12, 14, 16, 18, 20, 22, 24"
TBUG	10, 12, 14, 16, 18, 20"
TBUH	10, 12, 14, 16, 18, 20"
TBUK	Attachable Handle—Clamps on cathode hook
1224	Tapered Stainless Steel Nut
1224-1	Stainless Steel Stud
1224-2	Plastic Cover Cap
1226	Plastic Plug for unused holes
1225	Boot—Used to cover cut end of sectional member

Send for bulletin illustrating the great variety of BELKE Removable Tips for Thinker Boy Racks.

When Thinker Boy Racks of one type or style are no longer needed they do not become worthless as do other racks. The parts can be used in racks of different styles or stored in small space for future needs.

These great economies are possible because Thinker Boy Racks are made of standard, precoated parts assembled with screws. Disassembly or conversion to other styles is fast, easy and extremely practical.

A new illustrated bulletin, just off the press, shows how to make racks designed with Thinker Boy Sections. Send for your copy today—it's the key to revolutionary reduction in plating rack costs.

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EVERYTHING FOR PLATING PLANTS

pleted, PRESIDENT WILLIAM FORDNEY turned the meeting over to LIBRARIAN ARTHUR ARSENAULT, who introduced the speaker, LEONARD P. FOX, Chemical Engineer at the Lancaster Plant of RCA. He spoke on "Plating in the Television Field at the Lancaster Plant".

With the aid of a number of slides, Mr. Fox gave a very complete description of the plating set-up and stated that there is no decorative plating at the Lancaster Plant. Plated for protection, these coatings must adhere at very high temperatures, in some cases, 1100° C. Impurities in the plating bath are also very critical with cadmium and zinc among the dangerous metallic impurities. With these conditions existing, a constant control of the baths is necessary. Probably the most unique processes in which plating is employed is the manufacturing of the fine copper image screen (500–1500 lines per inch).

A general discussion on protective coatings available for use in plating rooms to provide the best protection of equipment followed.

After the meeting was adjourned those present enjoyed a Dutch lunch through the courtesy of the members of the Branch from the Hamilton Watch Co.

HARRY A. SAYLOR, *Secretary*

LOS ANGELES BRANCH

The speaker for the December meeting was G. C. JENISON, head of the Chemical Development and Research Division, Weirton Steel Company. His talk was entitled "Tin Plate" and this subject was thoroughly covered in historic sequence starting from the ancient methods of tinning up to the present high speed electrolytic tin strip plating. Two methods of tinning were described: the hot dip method, and the electrolytic strip method, the latter developed mainly during the last ten years and was given great impetus by the necessity of extending the critical supply of tin at the time. Both alkaline and acid baths used in the electrolytic tin strip-plating have certain defects for all around use, though the acid bath is now used by several of the largest lines in the country.

Mr. Jenison brought out that approximately 50 per cent of the tin consumption in this country goes into tin plate.

Slides were also presented to visually demonstrate the points brought up as well as to give much of the presented data in a more concise form.

A sound-color film on usage and manufacture of tin plate was presented prior to the question-and-answer period.

An invitation was extended at the time by the Kaiser Steel Company for all members of the Branch to visit the new Kaiser Strip Tin Mill at Fontana, Calif., at a date to be set at our mutual satisfaction.

The January Dinner meeting was held at Rodger Young Auditorium on the 14th with about 90 members and guests in attendance. During the business session further plans for the Annual Educational Session to be held on March 21 at the Statler Hotel were announced.

LIBRARIAN STUART KRENTEL introduced the speaker of the evening, HUBERT GOLDMAN, Enthone, Inc., who spoke on "Adhesion of Electrodeposits and New Methods of Cleaning and Oxide Removal". Mr. Goldman's talk was accompanied by an actual demonstration of some of these new methods. An active question-and-answer period followed and the meeting was adjourned at 10:05 P. M.

EARL W. ARNOLD, *Secretary*

LOUISVILLE BRANCH

A regular monthly meeting was held December 18 at Korfhages Restaurant with 24 members and guests present.

During the business session, the following were elected to membership: LINFORD L. JONES, RAYMOND J. NARDELLI, JOHN S. HOUSTON, MARIO CLEMENTI, P. JAMES GROTE, HARRY L. WUEBBOLD and ALFRED O. HOOK.

HENRY D. BOWEN was transferred to Louisville from the Philadelphia Branch.

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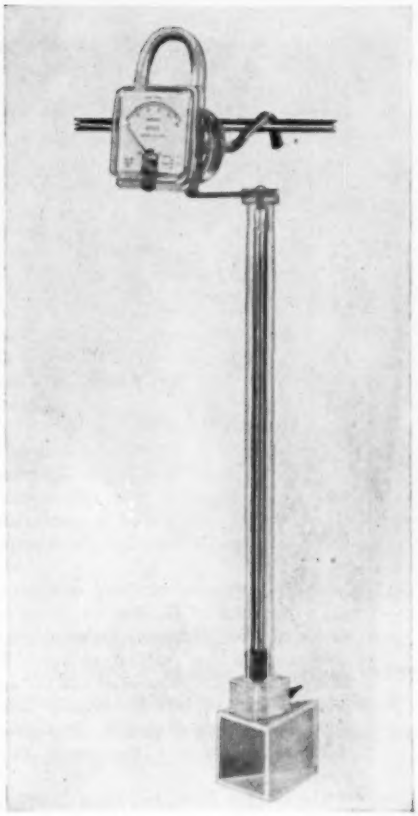

- Tests actual production conditions with one test for: BATH COMPOSITION, PLATING RANGE, THROWING POWER, OPTIMUM AGITATION, PROPER CLEANING and CURRENT DISTRIBUTION.
- Easy to suspend on cathode busbar (just as you hang a rack of work).
- Enables frequent spot checking with almost no time or effort. Minor bath corrections can be made immediately.
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Branch News

JOHNSON of the Belke Manufacturing Company, Chicago, Ill., a full length film of real action scenes was shown. Refreshments were served, courtesy of the Belke Manufacturing Company.

J. G. STERLING,
Secretary-Treasurer

NEW HAVEN BRANCH

The first meeting of the Fall season was held on October 14 in the Sterling Laboratory of Yale University. About 40 members were present to greet their new staff of officers who are:

President—GEORGE A. TRACCHIO
Vice-President—LAWRENCE J. DURNEY
Secretary-Treasurer—BERNARD J. GAFFNEY
Librarian—EDWARD F. BUSBY
Assistant Librarian—AUSTIN P. JACKSON
Sergeant-at-Arms—WM. K. MURRAY
Historian—JOHN W. ENGLISH
Board of Managers: JOHN M. BARRY, WALTER T. LYNCH and HENRY B. SMITH

A minute of silence was kept in memory of GEORGE KNECHT whose sudden death was felt by the entire Branch.

The speaker of the evening was DR. HAROLD NARCUS, President and Technical Director, Electrochemical Industries, Inc., Worcester, Mass., whose subject was "Role of Chelating Agents in the Plating Room". Dr. Narcus gave the members valuable information regarding this relatively recent development and their potential use in the plating field.

The November meeting was held on the 11th in the Sterling Laboratory of Yale University.

The members approved the additional charge of $1.00 in their dues to be used for Research only.

HUBERT M. GOLDMAN, Epthone, Inc., was the speaker of the evening and his subject was "Electroplating of Aluminum Alloys". Hubert and his firm have pioneered in this field of electroplating and the members derived a wealth of information on the finishing of various alloys from the talk and the lively question period that followed.

B. J. GAFFNEY, *Secretary-Treasurer*

NEWARK BRANCH

The annual technical meeting was held on December 12. In a short business session, EMIL TORSH, JOHN R. MIGLIN and OLIVER R. JACKSON were elected to membership following which LIBRARIAN TOM AUSTIN introduced the first speaker of the evening, C. F. NIXON, Past President of the A. E. S. His subject was "What Is Quality"? He spoke on automobile bumpers on General Motor's cars and bumpers on other makes of cars being plated with copper-nickel-chrome and copper-chrome and illustrated with slides the test results of different periods of time.

Introduced next was DR. R. B. SALTONSTALL, Technical Director of the Udylite Corporation, whose subject was "Nickel Plating Today and Tomorrow". The talk covered the progress of nickel plating from the year 1870 to the present day, and noted that the outlook for an increase in the amount of nickel available for the plating industry in the near future was not very bright.

GEORGE REUTER,
Recording Secretary

NEW YORK BRANCH

A meeting was called to order by FIRST VICE-PRESIDENT A. FUSCO on January 9 at the Hotel Statler, New York.

After a short business session, P. VEIT presented a three-reel sound and color film, "Corrosion in Action", by the International Nickel Company, which was most interesting.

LESTER LEVINSON,
Recording Secretary

PHILADELPHIA BRANCH

A regular meeting was held at the Harrison Laboratory on Friday, December 12. The guests were introduced; two new active members were admitted and one application was received.

Motions were passed that the Branch send all three Delegates to the Columbus Interim Meeting and that DR. SAMUEL HEIMAN's name be placed in nomination for Third Vice-President of the Supreme Society.

BRANCH PRESIDENT POPE announced the resignation of C. BROOKS RICCA as editor of the "Reminder" and the appointment to this position of IRVIN K. HAUSEMAN. Also announced was the appointment of the 1953 Nominating Committee: EUGENE ZURBACH, Chairman; ALBERT HIRSCH and FREDERICK FULFORTH.

The speaker for the evening, IRVIN K. HAUSEMAN, Pottstown Plating Works and Philadelphia Branch member, spoke on "Copper Striking on Zinc Base Die Castings". This was an oral presentation of Mr. Hauseman's paper that appeared in PLATING, October, 1952. It was augmented by slides and a large variety of plated specimens of the various effects obtained. The talk was followed by a spirited general discussion on this phase of plating.

The meeting adjourned at 9:55.

I. WM. MARCOVITCH, *Secretary*

PITTSBURGH BRANCH

The Pittsburgh Branch held its monthly meeting at the Sheraton Hotel on December 11. Twenty members enjoyed a good dinner prior to the business meeting at

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which approximately 40 members and guests were present. The officers and committee chairmen presented reports on their various projects.

BILL WILSON, Annual Banquet chairman, reported progress on plans for the affair to be held at the Sheraton Hotel on May 2.

Two new applications for membership were received: HARRY A. EARLY and HENRY J. SCHALTENBRAND, both of the Pittsburgh Commercial Heat Treating Company.

The LIBRARIAN introduced the speaker for the evening, F. H. KAHLER, Illinois Water Treatment Company, Rockford, Ill. The subject which Mr. Kahler so ably discussed was "Use of Ion-Exchangers in the Plating Industry". An interesting question period followed Mr. Kahler's main presentation.

Refreshments were enjoyed by all in the regular social gathering after the main meeting.

R. H. SCHINDLER, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

A regular meeting convened at the Providence Engineering Hall on January 19 with about 54 present. PRESIDENT FRANK BOOTHROYD, introduced the speaker of the evening, DR. GEORGE P. SWIFT, First Vice-President of the National Society. The subject for his talk was "Barrel Gold Plating of Small Parts". He discussed the type of solution used and the necessary control in respect to cost, pointing out one case where there was more gold on the parts than the firm was charging for the part.

The talk was followed by an extensive discussion, which is to be expected on a subject of this kind in the jewelry area.

G. A. GIBBS, *Secretary*

SAGINAW VALLEY BRANCH

Fifty-six members and guests attended the January meeting of the Saginaw Valley Branch at Zehnder's Hotel in Frankenmuth, Mich.

One new member was elected to the Society, HENRY V. PFEUFFER of Pontiac, Mich.

At the conclusion of the routine business session, LIBRARIAN BRISSON introduced the speaker, UYVAL C. JONES, Sales Manager of Duggan Masking Devices, who gave a very interesting talk on "Masking Devices and Plating Racks".

Entertainment for the evening was furnished by Mr. Jones, who presented a barber shop quartet, "The Oaklandaires", members of the Detroit Chapter No. 1 S.P.E.B.S.Q.S.A. All present enjoyed the Quartet's singing during and following the dinner, and before the evening was over it was found the Society has the makings of a quartet among our members.

A very colorful film on fishing was shown through the courtesy of JOHN KNOWLES of Macco Products who also donated the door prize which was won by JAMES DUNN of United Chromium, Inc.

D. WM. SNYDER,
Recording Secretary

SAN FRANCISCO BRANCH

A regular meeting was held on November 13 at St. Julien Restaurant. The speaker for the evening was MR. MACDONALD of the C & M Plating Works, San Francisco, who covered the subject of "Practical Rochelle Salt Copper Plating". He stressed the conventional and high-speed copper baths, showing the proper control and procedure for both.

The business session, held after the talk, saw the following new members elected: MAURY W. MAEDE and JOSEPH L. GOZBULAK.

The meeting was adjourned at approximately 11:30 P. M. by PRESIDENT J. R. PATTENGER.

In place of a regular monthly meeting, the Branch held its annual Christmas Party on December 13, at the Italian Village. The party, restricted to members

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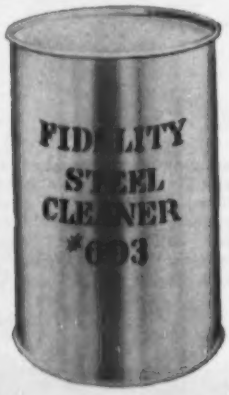

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Now with our new plant in full production there's no need for you to fool around and be a guinea pig for some "Johnny-Come-Lately" to the glass fiber and resin tank field. In the table below are dozens of standard sizes of the original plastic plating tanks which have taken the industry by storm because of their advantages of strength, lightness, chemical resistance and excellent di-electric properties. Many of these sizes can be shipped within 24 hours of receipt of order, all others within a week or less.

When you buy a PLA-TANK product, be it tank, hood or duct work, you benefit from our years of experience making these products for platers. They're engineered by men who know electroplating equipment and are backed by the makers of LUSTER-ON®, the nation's favorite passivating dip for zinc and cadmium.

Others may copy both PLA-TANK and LUSTER-ON. No one, BUT NO ONE can offer the technical service and actual experience in the field with these products that go with your purchase of them.

CHOOSE FROM A FULL RANGE
152 Sizes of Standard Tanks

TAPERED SIDE TANKS (Inside Dimensions at Halfway Depth)				TAPERED SIDE TANKS (Inside Dimensions at Halfway Depth)				STRAIGHT-SIDED TANKS (Inside Dimensions)				CROCKS (Inside Dimensions)		
Length		Width	Depth	Length		Width	Depth	Length		Width	Depth	Dia.	Height	Gals.
20	x	3	x 4	**24**	**x**	**24**	**x 30**	23½	x	16½	x 11	**10**	**x 10**	3¼
12	x	4	x 6	30	x	30	x 30	12	x	12	x 12	**18**	**x 20**	**20**
216	x	12	x 6	32	x	8	x 30	18	x	12	x 12	**18**	**x 30**	**30**
18	x	6	x 8	**36**	**x**	**24**	**x 30**	16	x	16	x 14	**22**	**x 32**	**50**
144	x	10	x 8	**48**	**x**	**12**	**x 30**	15	x	12	x 16	**25**	**x 36**	**70**
8	x	5	x 10	**60**	**x**	**24**	**x 30**	20	x	16	x 18	**30**	**x 46½**	**135**
10	**x**	**10**	**x 10**	**72**	**x**	**24**	**x 30**	28	x	20	x 24			
12	**x**	**12**	**x 12**	84	x	12	x 30	33	x	12	x 24			
30	x	24	x 12	92	x	12	x 30	72	x	24	x 24			
153	x	10	x 12	42	x	30	x 32	24	x	20	x 30			
156	x	8	x 12	**24**	**x**	**12**	**x 36**	**24**	**x**	**24**	**x 30**			
16	**x**	**16**	**x 14**	**24**	**x**	**18**	**x 36**	**30**	**x**	**24**	**x 30**			
30	x	15	x 16	**24**	**x**	**24**	**x 36**	**30**	**x**	**30**	**x 30**			
20	**x**	**16**	**x 18**	**36**	**x**	**24**	**x 36**	32	x	26	x 30			
24	**x**	**18**	**x 18**	**36**	**x**	**36**	**x 36**	**36**	**x**	**24**	**x 30**			
30	x	24	x 18	**48**	**x**	**30**	**x 36**	40	x	26	x 30			
12	x	4	x 20	48	x	48	x 36	42	x	24	x 30			
96	x	28	x 20	54	x	30	x 36	**48**	**x**	**24**	**x 30**			
24	x	12	x 24	84	x	36	x 36	48	x	26	x 30			
24	**x**	**18**	**x 24**	84	x	48	x 36	**60**	**x**	**24**	**x 30**			
24	**x**	**24**	**x 24**	60	x	12	x 36	72	x	12	x 30			
30	**x**	**24**	**x 24**	**72**	**x**	**24**	**x 36**	**72**	**x**	**30**	**x 30**			
36	**x**	**24**	**x 24**	**72**	**x**	**36**	**x 36**	72	x	48	x 30			
40	x	12	x 24	29	x	29	x 42	31¾	x	21⅝	x 30¾			
40	x	16	x 24	**36**	**x**	**24**	**x 42**	45	x	32	x 32	**Also 60 sizes of**		
42	x	30	x 24	**84**	**x**	**36**	**x 42**	28	x	20	x 34	**Cylindrical Open**		
48	x	24	x 24	**48**	**x**	**48**	**x 48**	**24**	**x**	**24**	**x 36**	**Top Tanks**		
53	x	18	x 24	**72**	**x**	**36**	**x 48**	35	x	24	x 36			
72	x	30	x 24	84	x	42	x 48	29	x	29	x 42			
24	**x**	**18**	**x 30**	144	x	36	x 84	60	x	36	x 45			
								36	**x**	**30**	**x 48**			
								48	**x**	**36**	**x 48**			

Bold-face sizes are usually in stock for immediate shipment, subject to prior sale. Others are built to your order on existing molds, shipment within a week.

We invite telephone or telegraph inquires for emergency needs, and can quote prices and make recommendations over the phone.

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THE *Chemical* CORPORATION

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Branch News

and their immediate families, was a tremendous success, comprising a cocktail hour, a full course dinner with wine, followed by a floor show starring Fifi D'Orsay, singing comedienne. Drawings held for the numerous door prizes contributed by the San Francisco-East Bay suppliers and shop operators found almost every couple in the group taking home a lovely prize, which included floor lamps, electrical appliances and decanters of I. W. Harper, Hiram Walker, etc.

HORACE J. SMITH,
Secretary-Treasurer

SOUTHEASTERN BRANCH

A regular meeting was held on January 9 at the Georgia Hotel. After the usual business session, LIBRARIAN C. H. HOHNER introduced the speaker of the evening, BRYANT H. GARDNER, Vice-President, The Chemical Corporation, Springfield, Mass. Mr. Gardner showed a very interesting picture of resin bonded fiberglass products known as Platank, used in making tanks and tank linings. A lively question and answer period followed the film presentation.

W. T. WEYMOUTH,
Secretary-Treasurer

ST. JOSEPH VALLEY BRANCH

A regular meeting was held at the Hotel Elkhart on January 7. Nineteen members and guests attended the dinner and technical session.

LIBRARIAN RALPH BROUWER introduced C. C. WEEKLY as our guest speaker. The topic was "White Brass Plating". In the plating bath he discussed, the deposit analysis approaches 85 per cent zinc and 15 per cent copper. He stated that compared to nickel plating, white brass plating costs can be 10 to 25 per cent cheaper. This alloy bath, like most alloy plating, is a bit more critical to operate than plain single metal baths, so that daily controls are most essential.

EUGENE ROTH, *Secretary-Treasurer*

TORONTO BRANCH

The Royal York Hotel was the scene of the regular meeting held on January 9. It was attended by a hundred members and guests who listened to an interesting paper by A. C. WEST, Assistant General Manager of Canadian Hanson & Van Winkle Company. Introduced by T. BOAZ, the speaker discussed "Anodes for Electroplating". In his talk, Mr. West noted the various anodes used for zinc, cadmium, copper and nickel plating. Considerable time was spent discussing the various types of nickel anodes and how they could be used to good advantage.

TWIN CITY BRANCH

The January meeting was held on the 5th at the Pine Tavern Cafe in Minneapolis with 30 persons present.

Following dinner, BRANCH PRESIDENT JEROME M. WELLER of Minneapolis-Honeywell Regulator Company introduced GEORGE BELAIR of Merchants Chemical Company who was a guest. RAFAEL DIAZ of Minneapolis-Honeywell Regulator Company was welcomed to the Branch as a new member as was C. BARTH, Merchants Chemical Company, who recently transferred from the Cincinnati Branch.

ALBERT JOYNER of the Silver Shop was greeted following his long absence due to illness.

Following the business meeting, BRANCH LIBRARIAN FRED KAIM of Superior Plating turned the meeting over to JOSEPH IRWIN of the Promat Division of Poor and Company who spoke on "White Brass Plating", a subject which was of considerable interest to all in attendance and a talk which was very well presented. There were several questions presented to Mr. Irwin and the meeting was enjoyed by all present.

ROBERT L. BUCKLEY, *Secretary-Treasurer*

WATERBURY BRANCH

The 8th of January turned out to be a stormy evening with plenty of snow to keep people at home. However, attesting to the popularity of DR. PETROCELLI'S subject, a larger than average group was present to hear his talk on polarography.

MESSRS. COLTER, COUCH, HENN and FOSTER were appointed to serve as a nominating committee for the forthcoming election of officers to be held this year on March 12. New officers will assume their duties the first of April to conform with the Branch fiscal year. MESSRS. HENN, COLLINS, and SLOANE were selected as

(*Continued on page 314*)

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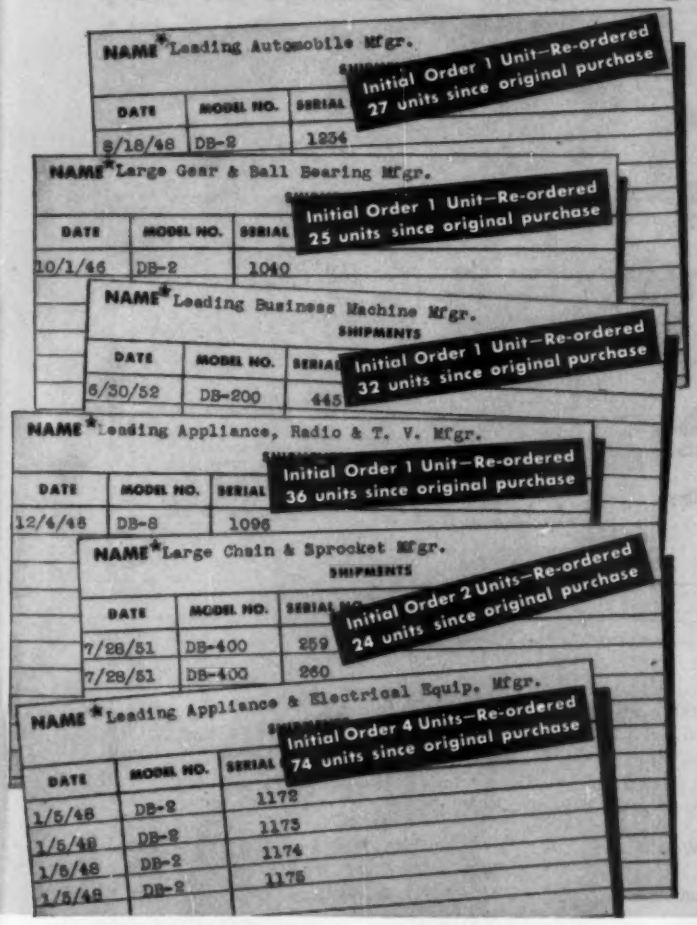
NAME* Leading Automobile Mfr.
DATE | MODEL NO. | SERIAL
8/18/48 | DB-2 | 1234
Initial Order 1 Unit—Re-ordered 27 units since original purchase
NAME* Large Gear & Ball Bearing Mfr.
DATE | MODEL NO. | SERIAL
10/1/46 | DB-2 | 1040
Initial Order 1 Unit—Re-ordered 25 units since original purchase
NAME* Leading Business Machine Mfr.
SHIPMENTS
DATE | MODEL NO. | SERIAL
6/30/52 | DB-200 | 445
Initial Order 1 Unit—Re-ordered 32 units since original purchase
NAME* Leading Appliance, Radio & T. V. Mfr.
DATE | MODEL NO. | SERIAL
12/4/48 | DB-8 | 1096
Initial Order 1 Unit—Re-ordered 36 units since original purchase
NAME* Large Chain & Sprocket Mfr.
SHIPMENTS
DATE | MODEL NO. | SERIAL NO.
7/28/51 | DB-400 | 259
7/28/51 | DB-400 | 260
Initial Order 2 Units—Re-ordered 24 units since original purchase
NAME* Leading Appliance & Electrical Equip. Mfr.
DATE | MODEL NO. | SERIAL
1/5/48 | DB-2 | 1172
1/5/48 | DB-2 | 1173
1/5/48 | DB-2 | 1174
1/5/48 | DB-2 | 1175
Initial Order 4 Units—Re-ordered 74 units since original purchase

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Membership Report of the A. E. S.

Elections

CHICAGO: Thomas S. Burdge, Henry G. Dobler, Thomas S. O'Donoghue, Edward Ruzicka

DAYTON: Fred M. Topping

DETROIT: Emil Olds, Frederick Parks, John W. Ward, Jr., Richard O. Watson

HARTFORD: Arnold E. Johnson

INDIANAPOLIS: L. Ralph Raymond, Marshal L. Whitehurst

JACKSON-LANSING: Richard W. Boos, James H. McKlueen

LOS ANGELES: Robert E. Becker, Jule H. Born, Jr., Kenneth W. Clayton, George Duncan, Howard R. Frace, Stanley Kritzer, John C. Murrieta, Robert C. Schwartz, Bert J. Sherwood, Lawrence D. Van Osdell, Alexander McG. Worman

MILWAUKEE: Charles J. Doria, S. L. Perkins, Edward T. Stroinski

NEW YORK: Bernard Baer, Leonard Bowman, Raymond Buttacavoli, Sidney Gewertz, Robert C. Horton, Michael Katz, Joseph Krahel, Jacob Kushner, Nattan Mash, Harold Rosenberg, Eugene P. Schimmel, (Mrs.) Tamar Y. Susskind, J. Robert Wasilewski

PITTSBURGH: Franklin Cutshaw, Harry A. Early, Harold L. Franks, Henry J. Schaltenbrand

PROVIDENCE-ATTLEBORO: Lester H. Darigan, Jr.

SAN FRANCISCO: Joseph L. Gozrulak, Maury W. Maede

SOUTHEASTERN: Charles A. Collings, C. L. Estes, J. A. Tony

SYRACUSE: Eric A. Berical, Charles A. Bridgett, Charles O'Harris, Fremont C. Schneider, Edward H. Wallace

TOLEDO: Harold C. Duggan

TORONTO: W. F. Baylay, T. F. Burton, Karlheinz Layer, James Robertson, Tadeusz Zagozdzon

TWIN CITY: Rafael Diaz

MEMBER-AT-LARGE: W. R. Barnes, Newport News, Va.; Werner Fluchmann, Zurich, Switzerland; Paul E. Goree, Jackson, Miss.; Henk Wijsman, Amsterdam, Holland

Reinstatements

DETROIT: Richard J. Clauss (Armed Services)

INDIANAPOLIS: Harold J. La Casse

LOS ANGELES: James Carter, Ralph A. McDonald

MELBOURNE: H. J. Merton, [suspended in error]

PHILADELPHIA: Lee M. Raden

PITTSBURGH: G. C. Gardner

PROVIDENCE-ATTLEBORO: Dr. C. B. F. Young

SYRACUSE: Gerald W. Backus

Transfers

Arthur E. Krause from Chicago to Toledo; Allen S. Brumm from Grand

Membership Competition

	Membership Apr. 1, 1952*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Toronto	132	17	+17	+12.1
Milwaukee	145	19	+15½	+10.7
New York	305	40	+32½	+10.7
Grand Rapids	155	17	+ 9	+ 5.8
Newark	240	14	+ 9½	+ 4.0
Hartford	148	9	+ 4	+ 2.7
Detroit	491	37	+11½	+ 2.3
Pittsburgh	132	17	+ 3	+ 2.3
Boston	140	5	+ 2	+ 1.4
Los Angeles	218	16	+ 3	+ 1.4
Bridgeport	154	3	+ 1½	+ 1.0
Chicago	469	56	+ 1	+ 0.2
Cleveland	212	12	− 3½	− 1.7
Melbourne†	168	19	− 8	− 4.8
Philadelphia	203	12	−11	− 5.4
Second Group				
Saginaw Valley	71	14	+14	+19.7
Rochester	88	22	+15	+17.0
Montreal	72	8	+ 7	+ 9.7
New Haven	88	7	+ 8	+ 9.1
St. Louis	102	8	+ 8	+ 7.8
Syracuse	104	16	+ 7	+ 6.7
Cincinnati	80	7	+ 5½	+ 6.3
Waterbury	115	1	0	0
Buffalo‡	107	4	− 1	− 0.9
Baltimore-Washington	96	5	− 2½	− 2.6
Providence-Attleboro	92	6	− 3½	− 3.8
Dayton	81	7	− 3½	− 4.3
St. Joseph Valley	74	6	− 3½	− 4.7
Sydney	86	5	− 4	− 4.7
Indianapolis	114	6	− 8½	− 7.5
Rockford	79	3	−15	−18.9
Third Group				
Louisville	24	25	+23½	+97.9
Wichita	...	12 (19)	+12	+63.2
Toledo	39	11	+15	+38.5
Western Ontario	19	8	+ 4	+21.1
Houston	40	11	+ 7½	+18.8
Southeastern	47	16	+ 7½	+16.0
Hamilton	22	3	+ 3	+13.6
San Francisco	67	13	+ 8	+11.9
Kansas City	...	4 (34)	+ 4	+11.8
Dallas-Forth Worth§	69	15	+ 7½	+10.0
Adelaide	58	6	+ 6	+10.3
Allentown-Reading	44	4	+ 4½	+10.2
Jackson-Lansing	59	6	+ 5	+ 8.5
Twin-City	66	9	+ 3½	+ 5.3
Springfield	55	4	+ 2½	+ 4.5
Lancaster	67	6	+ 3	+ 4.5
Columbus	54	7	− 1½	− 2.8
Outside Competition				
At Large	125	22	+23	.....
In Transfer	23	..	.....	.....
Total A. E. S.	5,739	653	+261	+ 4.5

Active Membership, December 31, 1952 6,000

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1951–1952 membership competition.

Arthur E. Krause from Chicago to Toledo; Allen S. Brumm from Grand

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The same high quality Hysol rack, tank and duct coatings—proved in service for over three years—are now available at *New Low Prices*. Increased production efficiency has enabled us to reduce costs and pass savings along to you—from 17% to 22%, depending upon quantity ordered.

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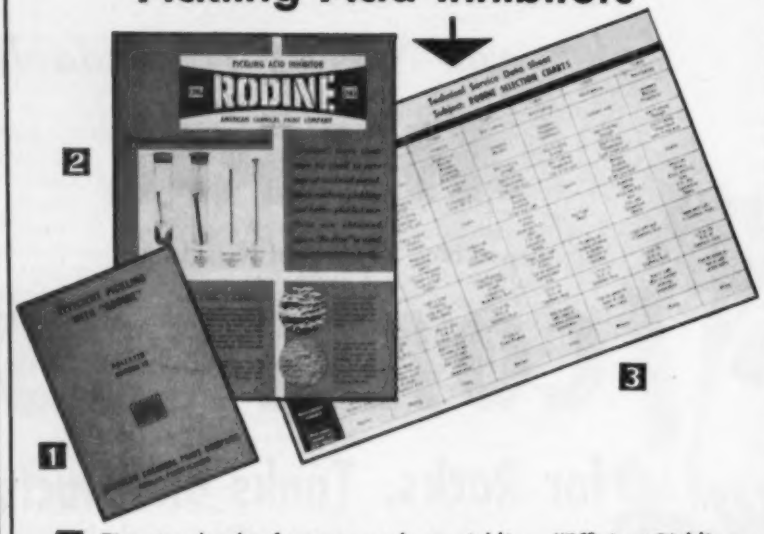

1 The standard reference work on pickling, "Efficient Pickling With RODINE" — Bulletin Number 13 — is now available in a new, revised edition.

2 This new 4-page general descriptive folder presents essential information on "Rodine" pickling acid inhibitors.

3 The recently revised "RODINE SELECTION CHART" gives characteristics of and uses for typical "Rodines" used with sulfuric and muriatic acids. Technical Service Data Sheet No. 13-1-1-4.

Use coupon below for free copies of the literature described above.

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Company Name .....

Address .....

City ..... State .....

Rapids to Chicago; John E. Hunt from Detroit to Chicago; Robert H. Tiers from Philadelphia to Hartford; Harold J. La Casse to Chicago from Indianapolis; William B. Johnson from Chicago to Los Angeles; H. R. Smallman from Chicago to Los Angeles; Henry D. Bowen, Jr. from Philadelphia to Louisville; Harry C. Haines to Waterbury from New York; John Gade to Cleveland from Pittsburgh; James L. Kelch to Cleveland from Pittsburgh; R. E. Shaw to Cleveland from Pittsburgh; Arthur H. Stevens from New Haven to Waterbury; C. P. Barth from Cincinnati to Twin City

Suspensions

BUFFALO: Bernard Noel
CINCINNATI: Charles C. Curtin
NEW YORK: Murray Paley, Albert O. Sieber, S. Rosenberg, Jack Topfer
SAN FRANCISCO: Frank Cavallero, Ronald H. Gordon, Emil Kachman, Gabriel A. Rodriguez

Deaths

BOSTON: Paul S. Lajer
DETROIT: Charles H. Eldridge
GRAND RAPIDS: Clyde Craven
MILWAUKEE: Bernard Ritter
NEWARK: John P. Roos
SPRINGFIELD: Frank Clark

Branch News

(*Continued from page 310*)

delegates to the New England Regional Meeting. Saturday, May 9, has been selected for that meeting at the Hotel Kimball in Springfield. Waterbury will obtain the speakers and provide the educational program.

In line with the talk of the evening, DR. DUBPERNELL reviewed the new two volume book entitled, "Polarography" by Kolthoff and Lingane.

DR. J. V. PETROCELLI, Director of Research and Development, Patent Button Company, Waterbury, delivered the paper, "The Polarographic Analysis of Plating Solutions. Part I. Nickel Solutions", of which he is co-author with GEORGE TATOIAN. It gives a brief review of polarographic methods and their potentialities in the study and control of plating solutions, outlining the general principles and techniques and describing a new manual polarograph specifically designed and developed for application to the analysis of e'ectroplating solutions.

Following the presentation, George Tatoian, Chemical Engineer, Patent Button Company, demonstrated the instrument and the methods. The prolonged discussion on the merits of the method as compared to conventional analysis points the interest in newer, more efficient tools in solution control.

SPENCER L. HENN, *Secretary*

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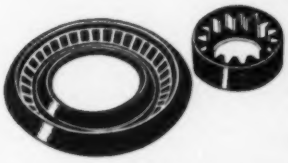
CONTINUOUS ADHESION



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MICCROSOL E-1003 Heat-Cured Rack Coating is a 100% solids, non-evaporating material that produces a smooth, tough, leather-like coating which will often outlast the rack. Exceptional adhesion is achieved through the use of our primers.

In addition to the outstanding characteristics listed above, tests for abrasion and resistance to all commonly used plating solutions, acids, and caustics show superior performance in comparison to similar products. MICCROSOL E-1003 has proven to excell as a coating for materials-handling equipment, baskets, hangers, and a wide variety of plating equipment parts.

MICCROSOL E-1003 has an exceptionally high gloss, allowing free drainage, and no solution carry-over.

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MILLER POLISHING WHEELS

Designed for Lower Costs—Higher Production at the most pieces per minute per wheel with the custom made Miller Polishing Wheels.

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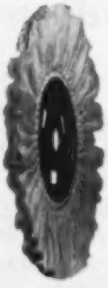
For economy and top dollar value you can't beat the universally accepted Miller Master Polishing Wheel. Its patented features bring you results no other wheel can offer. ALL MILLER POLISHING WHEELS ARE TAILOR MADE TO YOUR SPECIFICATIONS.

STANDARD CONSTRUCTION

Miller Polishing Wheels are fabricated from any material required in a full range of sizes from small 3" wheels for flexible shaft operation to huge 26" and 28" heavy duty wheels for polishing plow shares.



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The complete line of Miller Buffs offers you a job tailored line of buffs to meet all requirements on your buffing line. A complete range of type and grade from color pieced to bias sewed are available. Most important, Miller Buffs are packed full of engineering features that mean savings to you.

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3. **Minimize need for decanting or filtering.**
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CINCINNATI BRANCH, A. E. S., 1st Educational Session (2:00 P. M.) and Dinner-Dance (7:00 P. M.) at the Sheraton-Gibson Hotel on March 28, 1953.

THE ELECTROCHEMICAL SOCIETY, Spring Meeting at the Statler Hotel, New York City, on April 12–16, 1953.

BOSTON BRANCH, A. E. S., 17th Annual Educational Session (2:00 P. M.) and Banquet (7:00 P. M.) at the Statler Hotel on April 18, 1953.

DAYTON BRANCH, A. E. S., Annual Educational Session and Dinner-Dance at the Biltmore Hotel on April 18, 1953.

ROCKFORD BRANCH, A. E. S., 11th Annual Educational Session and Banquet at the Faust Hotel on April 18, 1953.

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